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UNIVERSITY REGISTRATION STATISTICS

THE registration returns for November 1, 1910, of twenty-seven of the leading universities of the country will be found tabulated on the following page. Four institutions exhibit a decrease in the grand total enrollment this year, viz., Harvard, Iowa, Indiana and Virginia, as against four institutions in 1909, two in 1908 and five in 1907. The largest gains in terms of student units, including the summer session attendance, but deducting summer students who returned for work in the fall, were registered by Columbia (with an unprecedented increase of 1,279 students), California (674), Minnesota (621), Wisconsin (500), Chicago (396), Northwestern (346) and Pennsylvania (330). Last year there were also seven institutions that showed a gain of over three hundred students each, but only one (Columbia) that registered an increase of over four hundred students. Omitting the summer session attendance, the largest gains have been made by Columbia (796), Minnesota (621), California (496), Wisconsin (407), Northwestern (379), Nebraska (236) and Chicago (231), seven universities exhibiting an increase of over two hundred students in the fall attendance, as against eleven last year, and it will also be observed that only one of the seven is an eastern institution, whereas the eleven last year were fairly evenly divided between the east and the west.

According to the figures for 1909, the twenty-eight universities included in the table ranked as follows: Columbia, Harvard, Chicago, Michigan, Cornell, Pennsylvania, Illinois, Minnesota, Wisconsin,

Faculties, November 1, 1910	California	Chicago	Columbia	Cornell	Harvard (Incl. Radcliffe)	Illinois	Indiana	Iowa	Johns Hopkins	Kansas	Michigan	Minnesota	Missouri	Nebraska	New York	Northwestern	Ohio State	Pennsylvania	Princeton	Stanford	Syracuse	Texas	Tulane	Virginia	Western Reserv	Wisconsin	Yale
College Men	694	761	729	722	2208	397	541	482	190	539	1257	705	517		352	418	400	434	1118	{ 836	{ 1330	581	107	338	405	918	1226
College Women	1080	688	521	261	487	475	373	486	.....	530	638	920	448		171	548	366	.....	.....		489	140	.....	303	785	.....
Scientific Schools*	780	.....	713	1576	121	1067	.....	176	.....	404	1243	562	544		206	54	790	803	203	490	355	254	148	90	.....	829	1024
Law	139	192	365	267	794	146	139	204	.....	210	740	367	212		725	240	166	345	.....	118	197	261	77	178	168	140	282
Medicine	91	141	316	159	279	514	186	134	395	89	318	169	47		495	477	.....	453	.....	17	108	167	439	78	166	48	82
Non-Professional Grad. Sch.	371	445	1167	288	456	269	139	101	200	66	135	54	99		291	78	65	397	130	125	70	.....	37	29	13	235	423
Agriculture	230	.....	.....	709	†	629	.....	.....	.....	.....	.....	1221	342		.....	.....	411	.....	.....	.....	.....	.....	.....	.....	.....	564	.....
Architecture	†	.....	155	133	†	273	.....	.....	.....	.....	†	11	.....		.....	.....	49	199	.....	.....	56	.....	18	.....	.....	.....	.....
Art	206	.....	.....	.....	†	4	.....	†	.....	39	.....	.....	.....		.....	.....	.....	.....	.....	.....	148	.....	126	.....	.....	.....	46
Commerce	241	.....	.....	.....	73	137	.....	†	.....	.....	†	.....	.....	‡	1079	547	.....	844	.....	.....	.....	.....	.....	.....	.....	310	.....
Dentistry	59	.....	.....	.....	117	140	.....	142	.....	.....	239	208	.....		.....	376	.....	453	.....	.....	.....	.....	67	.....	88	.....	.....
Divinity	.....	167	.....	.....	53	.....	.....	.....	.....	.....	.....	.....	.....		.....	207	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	95
Forestry	†	.....	.....	.....	†	†	.....	.....	.....	.....	†	112	.....		.....	.....	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	85
Journalism	.....	.....	.....	.....	.....	26	.....	.....	.....	.....	†	.....	91		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	†	.....
Music	†	.....	21	.....	.....	53	.....	45	.....	134	.....	.....	.....		.....	285	.....	25	.....	.....	764	.....	61	.....	.....	70	89
Pedagogy	†	228	1406	.....	.....	†	.....	†	.....	†	†	55	161		345	.....	59	.....	.....	47	94	†	64	.....	.....	.....	.....
Pharmacy	85	.....	283	.....	.....	160	.....	40	.....	68	81	90	.....		.....	194	87	.....	.....	.....	.....	51	14	.....	93	47	.....
Veterinary Medicine	.....	.....	.....	104	.....	.....	.....	.....	.....	.....	.....	.....	.....		15	.....	181	167	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other Courses	.....	573	.....	371	.....	39	.....	47	.....	.....	.....	183	.....		.....	135	191	534	.....	.....	99	32	44	.....	66	29	.....
Deduct Double Registration	*26*	*160*	*230*	*8*	.....	.....	*79*	*103*	*1*	*59*	.....	.....	*192*		*109*	*51*	*20*	*40*	.....	.....	*71*	.....	*104*	*25*	*28*	*73*	*65*
Total	3950	3035	5446	4582	4588	4329	1299	1754	784	2020	4651	4657	2269	3357	3570	3508	2803	4614	1451	1633	3150	1835	1238	688	1274	3902	3287
Summer Session 1910	1051	3370	2632	987	873	665	1137	345	.....	390	1226	457	597	444	529	75	637	689	.....	56	189	839	966	.....	.....	1263	.....
Deduct Double Registration	*243*	*522*	*667*	*400*	*132*	*335*	*304*	*142*	.....	*164*	*538*	*142*	*188*	*140*	*152*	*40*	*259*	*116*	.....	*41*	*91*	*77*	*219*	.....	.....	*420*	.....
Grand Total 1910	4758	5883	7411	5169	5329	4659	2132	1957	784	2246	5339	4972	2678	3661	3947	3543	3181	5187	1451	1648	3248	2597	1985	688	1274	4745	3287
" " 1909	4084	5487	6132	5028	5558	4502	2231	2246	710	2144	5259	4351	2589	3402	3843	3197	3012	4857	1398	1620	3248	2492	1882	767	1083	4245	3276
" " 1908	3751	5114	5675	4700	5342	4400	2113	2356	698	2086	5188	4607	2558	3154	3951	3113	2700	4555	1314	1541	3204	1446	1171	757	1016	3876	3466
" " 1907	3346	4594	5197	4293	5346	4172	1667	2188	651	1932	4953	4207	2274	2812	3648	2714	2344	4134	1311	1594	3162	1474	1219	757	914	3401	3435
" " 1906	3246	4731	4650	4075	5343	3810	1515	1950	618	1690	4674	3944	2071	2807	3283	2635	2180	3934	1352	1530	3004	1351	1285	745	905	3099	3477
" " 1905	3631	4557	4755	3871	5283	3635	1377	1700	688	1706	4521	3940	1887	2635	2912	2791	2057	3430	1361	1606	2776	1190	838	696	.856	3083	3477
" " 1904	3738	4035	4833	3833	5392	3369	1206	1460	740	1446	4000	3886	1704	2728	2380	2856	1758	3027	1385	1424	2452	930	1124	691	808	3370	3008
" " 1903	3690	4146	4557	3438	6013	3239	1614	1260	694	1319	3926	3550	1540	2513	2177	2740	1710	2644	1434	1370	2207	785	1037	638	765	3221	2990
Extension and Similar Courses	302	2800	1836	‡	7	.....	.....	.....	98	80	.....	65	.....	.....	750	142	.....	.....	.....	.....	.....	332	48	.....	116	605	.....
Officers	349	334	761	650	618	582	100	175	198	148	401	324	204	.....	343	440	233	485	177	292	250	116	216	97	256	486	499

* Includes schools of mines, engineering, chemistry and related subjects.

† Included elsewhere.

‡ No figures furnished.

Note.—The Texas and Tulane figures for 1903–1908 are exclusive of the summer session.

California, New York University, Nebraska, Yale, Syracuse, Northwestern, Ohio State, Missouri, Texas, Iowa, Indiana, Kansas, Tulane, Stanford, Princeton, Western Reserve, Washington, Virginia, Johns Hopkins. Comparing this with the order for 1910, we note that Chicago and Michigan have passed Harvard, that Pennsylvania has changed places with Cornell, that Illinois has been passed by Minnesota, California and Wisconsin, that California and Wisconsin have changed places, that Northwestern has passed Yale and Syracuse, that Kansas has outstripped Iowa and Indiana, as Tulane and Indiana have Iowa, and, finally, that Johns Hopkins and Virginia have changed places. For the first time in the annals of American universities the seven thousand mark has been passed, Columbia having a grand total registration this year of 7,411 students, a figure that will closely approach the eight-thousand mark before the end of the academic year. Pennsylvania is the sixth institution to pass the five-thousand mark; Cornell passed it in 1909, Chicago and Michigan in 1908, Columbia in 1907 and Harvard somewhat earlier. If the summer session enrollment be omitted, the universities in the table rank in size as follows: Columbia, Minnesota, Michigan, Pennsylvania, Harvard, Cornell, Illinois, California, Wisconsin, New York, Northwestern, Nebraska, Yale, Syracuse, Chicago, Ohio State, Missouri, Kansas, Texas, Iowa, Stanford, Princeton, Indiana, Western Reserve, Tulane, Johns Hopkins, Virginia, this order also showing a number of changes as compared with 1909, notably the advancement of Minnesota from seventh to second place.

Examining the various faculties in order, we find that the usual gains in the male undergraduate academic departments continue, the total increase being one of approximately a thousand students; it is impossible to calculate the increase with absolute accuracy, owing to constant changes of classification. On the other hand, it is noteworthy that the number of undergraduate women shows a decrease at the majority of the institutions in the list —quite an unusual condition. Harvard continues to lead in the number of male academic students, being followed by Michigan, Yale, Princeton, Wisconsin, Chicago, Columbia, Cornell, Minnesota; including the women, the order is Harvard, Michigan, California, Wisconsin, Minnesota, Chicago, Syracuse, Columbia, Yale, Princeton, Texas and Kansas, each of these institutions enrolling over one thousand academic students.

The number of scientific students is considerably smaller than it was last year, more than half of the institutions showing a loss compared with 1909. The chief gains were made by Illinois, Yale and Columbia, in the order given. The institutions that attract over five hundred students to their engineering schools are Cornell, which continues to maintain its old lead in this field, Michigan, Illinois, Yale, Wisconsin, Pennsylvania, Ohio State, California, Columbia, Minnesota, Missouri and Nebraska, in the order named, the first four universities mentioned enrolling over one thousand students each.

As was the case last year, there has been a decrease in the number both of medical and law students, this being due in the majority of the instances to a raising of the requirements for entrance to these professional schools. The largest gains in medicine have been registered by Western Reserve, California and Johns Hopkins, in law by Stanford, Columbia and Harvard; the largest losses in the former have been experienced by Northwestern, Pennsylvania and Iowa, in the latter by Virginia,

Yale and Texas. Illinois now attracts the largest number of medical students, followed by New York University, Northwestern, Pennsylvania, Tulane, Johns Hopkins, Michigan and Columbia, each of these institutions enrolling more than three hundred students. In law, Harvard and Michigan have passed New York University, these being followed by Minnesota, Columbia and Pennsylvania, the six institutions mentioned being the only ones in the table to attract over three hundred students.

Sixty per cent. of the graduate schools show an increase over last year's enrollment, and where losses are registered, they are slight. Columbia, Stanford and Illinois exhibit the largest gains, the first named institution, with an enrollment of 1,167 non-professional graduate students, having more than twice as many as the next largest, Harvard (456), which is followed in turn by Chicago, Yale, Pennsylvania, California, New York, Cornell, Illinois and Wisconsin, each of these institutions enrolling more than two hundred students. Over two thirds of the students enrolled in these eleven universities are to be found in eastern institutions.

All of the schools of agriculture continue to show a highly encouraging increase, Minnesota remaining at the head of the list, while Cornell has passed Illinois.—Of the architectural schools Cornell and Syracuse show slight losses, the others having registered an increase, especially Illinois and Columbia. The four largest schools are Illinois, Pennsylvania, Columbia and Cornell, in the order named, the two latter having changed places since the last year.—The largest schools of commerce are those of New York University, Pennsylvania and Northwestern, and all of these show very considerable gains in attendance over last year. Wisconsin and California have also increased their enrollment in this field, while Illinois and the Harvard graduate school of business administration have remained stationary. With the exception of Iowa and Tulane, all of the dental schools have increased their attendance, Northwestern, Illinois and Harvard showing the largest gains. The institutions continue to rank in the order Pennsylvania, Northwestern, Michigan, Minnesota, in this department.—Of the four divinity schools, Harvard alone shows a gain, the order in point of size being Northwestern, Chicago, Yale, Harvard.—At all of the institutions where the students of forestry are listed separately, a gain is apparent.—In the department of music, half of the institutions show a decrease in the number of students, this being especially large in the case of Northwestern and Wisconsin. Syracuse, Nebraska and Northwestern continue to have the largest schools.—In the department of pedagogy Minnesota, Missouri and New York University have suffered losses in attendance, while the other universities registered gains, especially the Teachers College of Columbia University, which exhibits an increase of no less than 432 students, it being by far the largest school of education in the country. It is followed by New York University, Chicago and Missouri, in the order named.—There has been a slight gain in the total number of students of pharmacy, the largest decrease having been experienced by Northwestern, the largest increase by Western Reserve, the other institutions being about evenly divided in the matter of gains and losses. The three largest schools continue to be Columbia, Northwestern and Illinois.—Ohio State, which has the largest school of veterinary medicine, has registered a loss of 21 students, Pennsylvania, which comes next, has

remained stationary, and Cornell and New York University have made slight gains.

The summer sessions are enjoying continued prosperity, especially noteworthy gains having been experienced by Columbia (664), Pennsylvania (240), California (232) and Tulane (184), while Harvard registered a decrease of 504 students. The only other decrease of moment was experienced by Northwestern, where the summer session in medicine has been abandoned; Iowa, New York University, Syracuse and Texas show slight losses, while Indiana, Michigan, Minnesota, Ohio and Stanford have remained practically stationary. Chicago continues to assemble the greatest number of summer students in its summer quarter, Columbia's summer session is rapidly nearing the three-thousand mark, while Wisconsin, Michigan, Indiana and California have over a thousand students each. Then come Cornell, Tulane, Harvard, Pennsylvania and Illinois, in the order named.

Of the New England colleges for men included in the following table, Dartmouth, Tufts, Wesleyan and Williams show gains over last year, Amherst and Bowdoin losses. Brown also shows a loss, as do Bryn Mawr and Mt. Holyoke, while Smith, Vassar and Wellesley have more students than last year. Massachusetts Institute of Technology, Lafayette and Oberlin have gained, Haverford, Lehigh and Purdue lost.—At Amherst the introduction of a group system of electives, as well as the inauguration of a one-half-year rule in public exhibitions, may have had some effect on the diminution in size of the entering class.—At Brown 657 of the college students are men, 199 women, and there are 74 graduate students enrolled.—At Bryn Mawr there are 69 graduate students. During the year 1909–10 this college received gifts amounting to $694,000.

Institution	1910	1909	1908	1904
Amherst	502	526	528	412
Bowdoin (incl. med.)	398	419	420	363
Brown (incl. graduate school)	930	974	993	988
Bryn Mawr (incl. graduate school)	409	412	393	441
Dartmouth (incl. eng., med., grad. stud. and commerce)	1,229	1,197	1,233	926
Haverford	150	157	160	146
Lafayette	496	468	455	422
Lehigh	616	667	662	609
Massachusetts Institute of Technology	1,506	1,480	1,462	1,561
Mount Holyoke	743	752	748	674
Oberlin (college of arts and sciences only)	998	953	855	652
Purdue	1,611	1,682	1,717	1,359
Smith	1,618	1,609	1,566	1,067
Tufts (college and engineering)	433	428	434	375
Vassar	1,058	1,039	1,014	979
Wellesley	1,378	1,319	1,282	1,050
Wesleyan	365	343	322	305
Williams	541	528	487	443

—At Dartmouth 1,144 students are registered in the college, 43 in the engineering school, 41 in medicine, 34 in the Tuck school of commerce and administration, and 21 are graduate students. There were also 151 students enrolled in the summer school of this institution, of whom 47 returned in the fall, giving a grand total of 1,333 students. Dartmouth has just completed a new gymnasium building, while an administration building is being erected for the college offices only.—Haverford College is completing a new science hall, principally for chemistry, and has received a donation from an alumnus for a building for the Haverford Union. The college has also introduced a pension system, for which a fund of $150,000 has been raised. —At Lafayette College 77 students are enrolled in the classical course, 135 in the Latin scientific, 45 in the general scientific, 47 in the chemical, 89 in the civil engineer-

ing, 55 in the electrical engineering, 34 in the mining engineering and 14 in the mechanical engineering course.—Lehigh University has 540 engineering students, 48 in the college, and 28 graduate students. The physical equipment of the university has been materially strengthened by the erection of two new laboratories—the Fritz engineering laboratory and the Eckley B. Coxe mining laboratory; the former is devoted to tests in strength of materials, cement and concrete, hydraulics and road materials, the latter to experimental ore-dressing. Both laboratories are equipped with the most modern machinery and apparatus. Four new four-year plans of study leading to the degree of bachelor of science are offered by the university in the department of arts and science, *viz.*, one in which the biological and chemical sciences predominate, one in which the geological sciences predominate, one in which the mathematical and physical sciences predominate, and one in business administration.—At the Massachusetts Institute of Technology German has been made a required subject for all first-year students with the exception of the architects, who are required to take French; previously all first-year students could choose between German and French. Of the 1,506 students enrolled at the institute this winter, 107 are in the school of architecture. There were also 239 students in attendance on the 1910 summer session, of whom 175 returned in the fall, giving a total enrollment for the year of 1,570.—At Mount Holyoke College a dormitory, accommodating about twenty-five persons, has been added during the summer.—The total fall registration of Oberlin College is 1,826, divided as follows: college of arts and sciences 998, theological seminary 65, conservatory of music 406, academy (preparatory) 315, drawing and painting (college and preparatory) 42.—The students at Purdue University are distributed as follows: school of science 162, chemical engineering 80, civil engineering 334, electrical engineering 390, mechanical engineering 306, graduate students 30, agriculture 262, and pharmacy 74. The entrance requirements for the school of pharmacy have been raised to correspond to those of all the other departments of the university, namely, four years of preparation in a standard high school, the increase in requirements having led to a twenty-five per cent. decrease in enrollment. An increase of no less than forty per cent. was registered in the freshman class of the school of agriculture. There has also been an appreciable increase in the number of women students, due to growth in the department of household economics. A notable addition to the resources of the university consists of the erection of a new group of buildings for the department of shop practise and drawing, comprising some 70,000 square feet of floor space with modern equipment.—At Smith College it is the object of the authorities at present to keep the enrollment as near 1,600 as possible, this being done by limiting the size of the entering class.—The total enrollment of Tufts College consists of 1,141 students, divided as follows: college, 111 men and 84 women, engineering schools 238, medicine 388, graduate students 7, dentistry 303, and divinity 10.—At Wellesley College there are 1,290 regular undergraduate students, 57 special students and 31 graduate students. Two new buildings have been added to the equipment, namely, a library and a gymnasium (Mary Hemenway Hall).—Of the 365 students at Wesleyan, 9 are women and 7 are graduate students.—At Williams 9 of the students are candidates for the degree of master of arts. A new infirmary and a

new auditorium are in process of construction and a new dormitory will be commenced soon. This is the first year in which no "partial course" freshmen have been admitted, all those that entered being candidates for the degree of bachelor of arts.[1]

RUDOLF TOMBO, JR.
COLUMBIA UNIVERSITY

SUMMARY OF THE FIFTH ANNUAL REPORT OF THE CARNEGIE FOUNDATION[1]

THE fifth Annual Report of the President of the Carnegie Foundation covers the year ending September 30, 1910. The report is divided into two parts. Part I. pertains to the current business of the year; Part II. is a discussion of the Relation of the College and the Secondary School.

The report shows that the trustees had in hand at the end of the year funds amounting to $11,114,056.86, consisting of the original gift of $10,000,000 par value of five per cent. bonds and one million accumulated surplus. The income for the year was $543,881.20. During the year 64 retiring allowances were granted, of which 46 were in accepted institutions and 18 in institutions not on the accepted list. During the year 23 pensioners died.

Among distinguished teachers who retired during the year were Professor Burt G. Wilder, of Cornell; Dean Van Amringe and Professor Chandler, of Columbia, both well advanced in years and in academic honors; Professor George L. Goodale, the famous botanist of Harvard; Professor Osborne, of the Massachusetts Institute of Technology, who has taught mathematics in that institution since its foundation; Chancellor MacCracken, of New York University; President Seelye, of Smith College, and Professor Calvin M. Woodward, of Washington University, St. Louis. These distinguished men average in age seventy-two years, and illustrate how well the vigor and influence of the scholar can be continued to a ripe maturity.

There were admitted to the accepted list during the year the University of California, the joint institutions of the State of Indiana —Indiana University and Purdue University —and Wesleyan University, the last named a college.

In the first part of the report the president of the foundation follows up the bulletin on medical education by a paper on the relation of the university to the medical school, in which he calls attention to the responsibility attaching to any college or university which undertakes medical education.

The second part of the report is a careful attempt to state the existing causes of friction between the secondary school and the college, and the loss of educational efficiency in the present methods of bringing pupils from the school to the college. The complaint of the college against the secondary school and the complaint of the secondary school against the college are set forth.

An extremely interesting part of the report is a statement of the observations of Oxford tutors upon the preparation of the Rhodes scholars. The strong points in the American boy's preparation are readily seen by these trained teachers, and the weaknesses which they find point directly to the superficiality and diffusion of the work done in the American secondary school and college.

The president of the foundation urges that this whole question be approached by secondary school men and college men in a spirit of cooperation. Neither the certificate method of admission nor the piecemeal examination method have, in his opinion, solved the problem. He urges that the college must find a solution which will test better than the certificate or the piecemeal examination the fundamental qualities of the student, and which will at the same time leave to the high school a larger measure of freedom. He recommends a combination of certificate and examinations, the latter of simple and elementary character, but calling for a high quality of performance.

[1] An abstract of this article appeared in the *Evening Post* (New York) of February 11.

[1] Press bulletin supplied by the foundation.

without which the candidate will not be admitted. For example, under this plan the boy who can not write good idiomatic English would not be admitted to college at all, but would be sent back to the secondary school. The entrance requirements recently adopted at Harvard are quite in line with these recommendations. The president of the foundation urges a cooperation between the secondary school and the college not as unrelated institutions, but as two parts of a common system of education. He argues that the interest of the great mass of high school students must not be sacrificed to the interest of the minority who are looking toward college. He insists on a larger measure of freedom for the secondary school, but on the other hand, he argues that the interest of the boy who goes to college and the boy who goes from the high school into business are alike conserved by learning a few things well, not by learning many things superficially. The boy who has obtained such intellectual discipline is a fit candidate for college, whether he has studied one set of subjects or another; without this intellectual discipline he is unfit alike for college or business. It is therefore, in the opinion of the president of the foundation, the plain duty of the college, at the present stage of American educational development, to articulate squarely with the four-year high school and to leave the secondary school the largest freedom so that it may educate boys, not coach them; but at the same time to require of the candidates for admission tests which rest upon high performance in the elementary studies and which mean mastery of the fundamentals. In such a program lies the hope of scholarly betterment and of civic efficiency for both college and high school.

The report may be obtained by writing to The Carnegie Foundation, 576 Fifth Avenue, New York City.

THE PUBLIC HEALTH SERVICE

The following bill has been introduced in the senate and in the house of representatives:

A Bill: To change the name of the Public Health and Marine-Hospital Service to the Public Health Service, to increase the pay of officers of said service, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Health and Marine-Hospital Service of the United States shall hereafter be known and designated as the Public Health Service, and all laws pertaining to the Public Health and Marine-Hospital Service of the United States shall hereafter apply to the Public Health Service, and all regulations now in force, made in accordance with law for the Public Health and Marine-Hospital Service of the United States shall apply to and remain in force as regulations of and for the Public Health Service until changed or rescinded. The Public Health Service may study and investigate the diseases of man and conditions influencing the propagation and spread thereof, including sanitation and sewage and the pollution either directly or indirectly of the navigable streams and lakes of the United States, and it shall from time to time issue information in the form of bulletins and otherwise for the use of the public.

Sec. 2. That beginning with the first day of July next after the passage of this act the salaries of the commissioned medical officers of the Public Health Service shall be at the following rates per annum: surgeon-general, $6,000; assistant surgeon-general, $4,000; senior surgeon, of which there shall be ten in number, on active duty, $3,500; surgeon, $3,000; passed assistant surgeon, $2,400; assistant surgeon, $2,000; and the said officers, excepting the surgeon-general, shall receive an additional compensation of 10 per cent. of the annual salary as above set forth for each five years' service, but not to exceed in all 40 per cent.: Provided, That the total salary, including the longevity increase, shall not exceed the following rates: assistant surgeon-general, $5,000; senior surgeon, $4,500; surgeon, $4,000: Provided further, That there may be employed in the Public Health Service such help as may be provided for from time to time by Congress.

SCIENTIFIC NOTES AND NEWS

At a meeting held on January 12 the Geological Society in Stockholm, Sweden, elected to eight vacancies in their twenty corresponding memberships, Frank D. Adams, Montreal; Charles Barrois, Lille; Eduard Brückner, Vienna; Albrecht Heim, Zürich; C. R. van Hise, Madison; James F. Kemp, New

York; Albrecht Penck, Berlin, and Charles D. Walcott, Washington.

DR. W. J. HOLLAND, director of the Carnegie Institute, Pittsburgh, has received from the Czar of Russia, the insignia of a knight of the order of St. Stanislas, second class, in recognition of his services to science; and Mr. A. S. Coggeshall, the chief preparator in the section of paleontology in the same institution, has had conferred upon him by the same sovereign knighthood in the order of St. Anne.

DR. HENRY PRENTISS ARMSBY, director of the Institute of Animal Nutrition of the Pennsylvania State College, has been elected a member of the Royal Society of Arts of Great Britain.

DR. H. LORENZ, professor of physics at Leyden, and Dr. E. Strasburger, professor of botany at Bonn, have been elected members of the St. Petersburg Academy of Sciences.

DR. HENRY FAIRFIELD OSBORN, president of the American Museum of Natural History and Da Costa professor of zoology at Columbia University, was given a dinner by his former students at the Faculty Club of Columbia University, on February 18, in celebration of his thirtieth anniversary as a teacher. About forty-five guests and former students under Professor Osborn at Columbia and Princeton Universities were present. Speeches were made by Professors E. B. Wilson, W. B. Scott and C. F. W. McClure.

DR. HENRY M. HURD has retired from the superintendency of the Johns Hopkins Hospital, and is succeeded by Dr. W. H. Smith, superintendent of Bellevue Hospital, New York City.

DR. ANDREW W. PHILLIPS, since 1891 professor of mathematics in Yale College and since 1895 dean of the graduate school, will retire from active service at the close of the present academic year.

CHARLES JOYCE WHITE, professor of mathematics at Harvard University from 1885 to 1894, has been appointed emeritus professor, and William Barker Hills, associate professor of chemistry from 1889 to 1904. has been appointed emeritus associate professor.

THE University of La Plata and the University of Michigan have arranged for cooperation in the work of their astronomical observatories. Professor W. J. Hussey has been appointed director of La Plata Observatory, but is still to remain director of the observatory of the University of Michigan. He will divide his time equally between the two institutions, spending the second semester of each year at Ann Arbor. Mr. R. P. Lamont, of Chicago, is furnishing a 24-inch refracting telescope for the University of Michigan. It is the intention to take this instrument, when completed, to a favorable site in Argentina, and while it is there to have it used under the joint auspices of the two universities.

PROFESSOR GILBERT N. LEWIS, of the Massachusetts Institute of Technology, will deliver eight lectures on "The Principle of Relativity," on Monday and Thursday afternoons, beginning on March 6, in the Jefferson Physical Laboratory of Harvard University.

UNIVERSITY AND EDUCATIONAL NEWS

IN the Massachusetts senate on February 21 the committee on education reported a resolve, on the petition of Richard C. Maclaurin, president, and others, for an increase in the state appropriation for the Massachusetts Institute of Technology. The resolve provides that there shall be paid annually, for ten years, to the institute the sum of $100,000, from January 1, 1912, to be expended under the direction of the corporation for the general purposes of the institute; the institute shall maintain forty free scholarships in addition to those already maintained.

MR. CARNEGIE recently wrote the board of trustees of the Carnegie Institute that he is prepared to increase the endowment income $50,000 or $100,000 a year if it can be shown that any department is hampered from lack of funds. The founder expects to visit Pittsburgh about May 1 to receive the report of the board.

AN alumnus, who wishes to remain anonymous, has given to Phillips Exeter Academy $18,744, with which to complete the Wentworth mathematical fund of $50,000. William

A. Francis has been elected the first Wentworth professor of mathematics. He has been professor of mathematics since 1892.

The Ohio house has passed the Cahill bill, which had previously passed the senate, providing for the compulsory teaching of agriculture in the common schools of villages and townships.

On February 15 and 16, about one hundred and sixty members of the Illinois general assembly went to the University of Illinois to make their biennial inspection. A convocation was held in the auditorium, at which time addresses were given by various members of the house and senate. In the afternoon a conference with members of the appropriation committee and heads of the departments was held, at which time the needs of the university were presented. The university is requesting from the legislature this year for maintenance and general equipment $2,201,000; also for new buildings, the sum of $1,150,000; for maintenance of the College of Medicine, $200,000. In addition to these requests it also is supporting the request of the College of Agriculture for $1,575,750 for maintenance and equipment. In addition to the above the mining interests of the state are supporting a bill proposing an appropriation of $240,000 for the construction of the mining engineering building and maintenance of the department of mining engineering. The ceramic interests are likewise supporting a bill proposing an appropriation of $45,000 for the department of ceramics.

Dr. John G. Bowman, secretary of the Carnegie Foundation, has been elected president of the Iowa State University to succeed Dr. George E. MacLean.

The Rev. Dr. George Edward Reed has resigned the presidency of Dickinson College after twenty-two years of service.

Recent appointments in the School of Mines of the University of Pittsburgh are Dr. Charles R. Eastman, of Harvard University, as professor of paleontology; Otto Emery Jennings, of the Carnegie Museum, as instructor in paleobotany, and James Z. Zimmerman as assistant in mining. Mr. George T. Haldeman, instructor in mining, has recently been appointed superintendent of the Mine Rescue Work of the Lehigh Valley Coal Company and Mr. Edward L. Estabrook, assistant in mineralogy, has been appointed instructor in petrology at Lehigh University.

Professor Victor R. Gardner, head of the department of horticulture at the University of Maine, has accepted the appointment of associate professor of pomology at the Oregon Agricultural College, to succeed Professor C. A. Cole, who has resigned to take up industrial work.

Ernest Gale Martin, Ph.B. (Hamlin), Ph.D. (Johns Hopkins), has been promoted to an assistant professorship of physiology at Harvard University.

Dr. Th. Paul, professor of chemistry at Munich, has been appointed director of the laboratory of inorganic chemistry at Leipzig, to succeed Professor Ernst Beckmann.

DISCUSSION AND CORRESPONDENCE

THE AIR WE BREATHE IN BUILDINGS

To the Editor of Science: Two or more years ago my attention was drawn to the astonishing and unfortunate condition of the throats and tonsils of school children and the number of children who had adenoids. This led, through a series of investigations, to a general study of the air which we breathe in buildings. This air we all know is, somehow or other, not as good for us, even under the best conditions of ventilation, as the open air.

For example, children in open-air schools systematically show greater increases in the number of red blood corpuscles during the school term than during vacation. The investigations of Benedict, Atwater, Paul, Heyman, Ercklentz and Flügge, and of Dr. Leonard Hill, of the London Hospital Medical College, have given us a body of as yet undigested, although fundamentally important, information.

Dr. Gilman Thompson and Dr. Brennan, of New York City, have changed the death rates in pneumonia and certain other diseases by placing the beds of patients either out of doors

or next to open windows. These two men think that we ought to do away with all systems of ventilation and use simply natural ventilation—open windows. On the other hand, Dr. Leonard Hill writes me as follows:

I have not published in extenso my researches on ventilation and have only communicated the general drift of them to the Institution of Heating and Ventilating Engineers over here, in whose transactions my remarks appear.

The whole point of my work is to force attention to the need of cool air of average humidity. It is not the actual percentage of O_2 or CO_2 that matters, but the temperature, the humidity and the movement of the air in houses, schools, etc.

I visited yesterday a London County council school in which is installed a Plenum system with separate shaft to each school room, giving a moving air at 57–60° Fahrenheit and about 70 per cent. relative humidity. All windows and doors are kept closed. The result is admirable; lively, attentive children (at 4 P.M.) and masters looking fresh; no smell of human beings—this was only noticeable when one stood actually among the boys, not in the free spaces of the schoolroom. The headmaster has had hardly any zymotic disease, and in every respect reports better conditions than in neighboring schools with no such efficient system. The children are reported to eat more after coming to school.

We know definitely that the difference between good and bad air does not consist primarily or to any great extent in variations of oxygen or carbon dioxide, and that there is no such thing as a subtle human poison (anthropotoxin) which varies in proportion to the CO_2.

We have tables which show the different temperatures and how air at, say, 32 degrees, with adequate relative humidity, becomes, when raised in temperature to, say 70 degrees, air practically without moisture. It appears that one of two things must have happened—either the heat must have contracted the existing moisture or the capacity of the air for moisture has been vastly increased by the rise in temperature.

Practically all of the best manuals of the heating and ventilating engineers tell us that with a good system of ventilation the opening of windows causes only danger; yet, as a matter of fact, children in rooms so treated do not exhibit the distressing conditions referred to at the beginning of this letter.

I have already secured and digested all of the literature to which reference is made in exhaustive bibliographies, indices, and the like, on the subject of air, changes in oxygen, CO_2, and so on, as well as the literature covering the relations of the vaso-motor system to the emotions on the one hand, and to skin circulation on the other.

I believe that the larger part of the question as to why vitality is decreased indoors can be answered through the correlation of these facts, which I already have. There are, however, certain facts which I have not, and which, so far as I have been able to find out, no one has studied. I am not a physicist, and do not know—neither do I know whether the physicists know—the reason why raising the temperature of air increases its capacity for water—in fact, its thirst for water.

I am writing to ask if any of the readers of SCIENCE know of any experiments which will throw any real light on the following questions.

Is there any difference between steam and humidity? Does steam act strictly in accordance with the ordinary laws governing the movement of gases? Does humidity in the air act exactly as steam does? I suspect that it does not, because heat causes steam to expand, whereas, when we raise the temperature of the air its capacity for moisture becomes vastly increased, which shows either that the steam has contracted or that the air has been altered in such a way as to permit of its absorbing a larger percentage of moisture than it did before.

I confess to a feeling of hesitation in presenting questions which must seem so elementary to your readers, yet when I presented to the American Society of Heating and Ventilating Engineers[1] some of the facts that we have recently discovered about the ventilation of school rooms in relation to the physical and mental condition of children they said that I

[1] *Heating and Ventilating Magazine*, February, 1911.

was upsetting the very foundations upon which heating and ventilating science was built.

It seems as if there must be somewhere in existence the knowledge which we need at the present time. Man has become in a comparatively few years a preeminently house-abiding creature. He lives in localities which are paved, where there is little opportunity for evaporation, which is a necessary condition for human living. Present conditions are not right. Does any one know in what respect our present schemes of ventilation are wrong, why delicate children and tuberculous persons get well out of doors, and fail to do so in-doors, and what we need to do to make in-door living as healthy as out-door living? If we can find the answers to these questions we shall have discovered something which will affect the vitality of all the children, and ultimately of all the adults, who live in buildings throughout the civilized world.

Any reference to original sources which any of your readers can give will be most gratefully welcomed.

Luther H. Gulick, M.D.
Russell Sage Foundation,
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"Mutations" of Waagen and "Mutations" of De Vries or "Rectigradations" of Osborn

It is important to distinguish clearly between what may be called the "mutations" of Waagen, the "mutations" of De Vries, and the rectigradations of Osborn. By careful examination of Waagen's original paper and the usage of this paper on the continent by subsequent paleontologists it appears certain that the mutations of Waagen are stages of transition between Linnæan species occurring in direct lines of phyletic ascent. These stages are distinguished by progress, although perhaps very slight in a number of different characters. The mutations of De Vries have not been distinguished in paleontology, but only in botany, and through botany extended to zoology. They represent the sudden or discontinuous jumps or saltations through which new characters arise. Definite direction is given to these characters only through selection. The "rectigradations" of Osborn are different in significance from either of the above; the term refers to the stages of single new characters occurring at definite points, hence originally termed by Osborn "definite variations." The mutations of De Vries can not be used by paleontologists, with whom the original term *saltation* would be preferable.

Henry Fairfield Osborn

Scientific Books

Inheritance of Characteristics in Domestic Fowl. By Charles B. Davenport. Carnegie Institution of Washington, Publication No. 121. Pp. i + 100, Pl. 1–12. 1909. Issued February 7, 1910.

This quarto volume contains a detailed account of the results of the continuation of the studies on inheritance in domestic poultry carried out by Dr. Davenport at the Station for Experimental Evolution at Cold Spring Harbor, the first instalment of the results of these investigations having appeared as Carnegie Institution Publication No. 52. A great mass of new and interesting facts are brought forth in the present work. The book is divided into twelve chapters, of which the first eleven deal severally with some of the characters which experience shows to be most difficult of definite analysis in respect to their hereditary behavior. Nearly every character discussed is one which at first acquaintance appears not at all to follow Mendelian principles (at least in their simplest form) in inheritance. Because of this fact they are of all the greater interest and significance to the student of heredity, and any systematic and thorough attempt at their analysis, such as is here made, is most heartily to be welcomed and commended, even though one may not be prepared to accept *in toto* the final interpretations reached. The extensive collection of facts brought together in this work loses none of its value if the theoretical interpretation should later be changed.

Chapter I. deals with the inheritance of the split or Y comb which appears in the progeny of a cross between a single-combed bird and one possessing a V or "horned" comb, such as

is found in the Polish fowl. The essential facts brought out are that the proportion of the median element to the lateral elements of the Y comb varies in the F_1 progeny all the way from 0 to 90 per cent. of median element. In the F_2 and subsequent progeny the amount of median element is distinctly correlated with the amount present in the parents. The author's interpretation of this is that median comb is imperfectly dominant over no-median comb, and that the degree (or potency) of dominance is inherited. Chapter II. deals with the inheritance of the extra toe found in various breeds of fowls. The facts here are that while "extra toe" is sometimes dominant, it sometimes fails to dominate. Lumping all statistics together, it would appear to be the case that the greater the degree of dominance of extra toe in F_1 the higher the proportion of polydactylous young produced in subsequent generations, thus apparently confirming Castle's conclusions regarding the inheritance of degrees of polydactylism in guinea-pigs. Analysis of the data with reference to gametic constitution of the parents, however, leads plainly to the conclusion that "the average condition of toes in the offspring of second or later generation hybrids can not be used as evidence of inheritance of the degree of parental development of the toes, since these are dependent upon the same basal cause, namely, the hidden gametic constitution of the parents."

Chapter III. deals with syndactylism, or "web foot" condition. This character apparently segregates as though it were dominant to normal foot, though the dominance itself may fail to appear in F_1. Chapter IV. deals with rumplessness, a character of certainly puzzling behavior in inheritance. Here the author's earlier provisional conclusion that rumplessness is recessive is reversed, and now this condition is held to be dominant, the allelomorphic factors being "inhibitor of tail" and its absence. The principle of imperfection of dominance is adduced to explain the fact that the F_1 progeny are tailed. Some data regarding the inheritance of presumably congenital winglessness are given in the next chapter, but definite conclusions are not reached. The next two chapters present some very valuable evidence on the much-mooted problem of the effectiveness of selection of fluctuating variations. The characters dealt with are booting (feathering of legs) and nostril form. The facts here are of great importance and almost unique in the literature in that *they give for a bisexual organism data as to definite grades of the character in individuals of known gametic constitution with respect to this character.* The results show at once the inherent fallacy of the basic assumption of the biometric method of dealing with inheritance, which tacitly assumes that all somatic variations are of equal hereditary significance,[1] and at the same time the failure of selection of fluctuating variations within a *gametically homogeneous* population (= the nearest thing to a "pure line" one can ever get in a bisexual organism) to produce any result. If all degrees of booting in parent and offspring of all sorts of gametic constitution are lumped together in one table there is a sensible correlation between parent and offspring. One might hence conclude that grades of booting are inherited in a blending fashion, and could be genetically modified by systematic selection of slight "favorable variations." If, however (and in showing this with such precision and clearness lies one of the most valuable contributions of the work), a table is made in which the individuals included are homogeneous gametically there is no correlation whatsoever between parent and offspring in respect to grade of booting. The offspring of parents with "much boot" have on the average no more of the character than those whose parents have "little boot," provided both sets of parents are gametically alike as regards "booting." Under these circumstances one would obviously not make progress in selecting for increased booting. Nostril form shows the same thing.

The next two chapters deal with crest

[1] Cf. a more detailed discussion of this point in a paper entitled "Biometric Ideas and Methods in Biology: Their Significance and Limitations," which is shortly to appear in "Scientia."

(showing that this structure depends upon two gametic characters, instead of one as hitherto supposed), and with comb-lop (showing that the direction of the lop is not apparently inherited). Chapters X. and XI. deal with various phases of the inheritance of plumage, color and pattern. A general gametic formula for poultry coloration is worked out and evidence presented in its favor. Data are given regarding the inheritance of certain pattern types.

The last chapter is devoted to a general discussion of certain theoretical matters of prime importance. Stress is laid upon the possible significance of "inhibitors" in addition to "determiners" in ontogeny. The "principle of imperfect dominance" is discussed at length. One fancies that here is where the greatest disagreement will be found amongst students of the subject. The reviewer, frankly, is unable to see that degree of heuristic worth in this concept which the author seems to find. It seems possible to account for all the facts on which this concept rests in other ways, not any the less in accord with Mendelian principles. Virtually these facts amount to an *apparent* failure of segregation. One may safely say that practically all students of inheritance whose study involves a real, first hand acquaintance with the living, breeding organisms are deeply impressed with the precision and definiteness of segregation *generally*. When apparent exceptions to the law of precise segregation occur one's zeal is aroused to discover the cause. There is a wide range of physiological factors beyond such things as "imperfection of dominance" which must be considered here (*teste* the work of Tower and of Tennent, for example). Probably every one will admit that the data now available do not permit any final conclusion as to what are the primary factors involved in causing apparent exceptions to Mendelian principles, either in general or in particular cases. What clearly are needed are more of such extensive collections of definite experimental data as are furnished in the work under discussion. We may well observe that caution expressed by Robert Boyle as an apology for not taking a more decided stand on theoretical questions: "having met with many things for which I could assign no probable cause, and with some for which many different ones might be alleged, I dare speak positively and confidently of very few things except of matters of fact."

Raymond Pearl

The Teaching Botanist. A Manual of Information upon Botanical Instruction. By William F. Ganong, Ph.D., Professor of Botany in Smith College. Second edition. Pp. 12 + 439, illustrated. New York, The Macmillan Company. 1910.

At a time when the teaching profession is being assailed on all sides with demands for a practical education, and when the meaning of "practical" is, in the main, materialistic, those teachers in botany still committed to ideals, but perhaps finding difficulty in harmonizing them with the proper demands of those seeking immediately useful training, will find a champion in the author of "The Teaching Botanist." Professor Ganong has worked long and consistently with the avowed purpose of trying to solve the problem of the content and method of an elementary course in botany. He may therefore be looked upon by the teacher seeking guidance as among the safest and surest. He would be the first to disavow the claim that he has quite answered the question to which his book is a large and satisfying reply, but we do not hesitate to say that he is far along on the right track.

"The Teaching Botanist" in its present form is called a second edition, but is very largely a rewriting. On the side of information, which the teaching botanist desires to have respecting the materials with which he deals, it has been brought down to date. The results of actual teaching experience during the last few years have been set down. In this sense the book is practical, in some directions almost encyclopedic, and will stand in good stead to one who is planning courses or equipping a laboratory. This will be understood to include also the matter of books, which are well discussed, and of which a full

list, so far as pertains to the teaching of elementary botany, is provided. Since school boards are sometimes in a hurry for data, it would have been well to facilitate the teacher's task by indicating in the list itself the relative values of the various books, so that a limited choice might be quickly made. This end is, however, largely attained in the reading of a chapter, but in a less concise way.

A very valuable addition in the present book are the suggestions given for the growing of plants in windows in pots and boxes. But few schools are able to do more than this, and any practical help in this apparently easy, but really rather difficult matter, will prove very welcome, especially as this part of the text comes from the hand of Mr. Edward J. Canning, than whom few are more skilful in horticultural practise. An additional suggestion will not be amiss, that tin cans are usually better than pots for house culture. Indeed, they are exceedingly useful for much laboratory experimentation. The jagged rims may be melted off, while a coat of asphalt paint will make them sightly.

During the past few years Professor Ganong and some of his more advanced students have systematically investigated the commoner plants with particular reference to their adaptability for demonstration and laboratory experimentation, while Professor Ganong himself has worked arduously in the perfection of apparatus of more refined type adapted to school and college use. The excellent data and apparatus thus obtained are available in *The Botanical Gazette* and in another book, "Plant Physiology," properly to be regarded as a companion volume to "The Teaching Botanist," and which should, with this, be in the hands of every ambitious teacher.

The second part is devoted to a detailed discussion of a synthetic course, the content of which is widely known through the work of the Committee on Education of the Botanical Society of America, of which Professor Ganong is the chairman. The method of presentation is left, in the report of that committee,[1] as a matter of choice to the teacher, but the book before us will do much to advance the recognition of the principle of synthesis. The account, covering 150 pages, may be regarded as a condensed log of a successful teacher, and gives the practical pedagogy on every difficult and important point. The fundamental principle, that of synthetic treatment of allied structural and physiological topics, has much to commend it, the chief of which is the overwhelming importance of physiology. The reviewer is glad that the efforts of Professor Ganong have been in this direction, since it is principally this phase of botanical science which must come to the front in the botany taught in schools of agriculture. These are rapidly multiplying, and many young teachers are going out year by year into this work who need much help along the right path.

Of most permanent importance, in the opinion of the reviewer, is the chapter on the Training and Traits of the Good Botanical Teacher. It is full of good common sense coupled with a clear vision of the ideal. The teacher who is troubled because he can not do research will find in this homily some other matters to think about and other ways of advancing his science than in striving to do the work of others whose business it is. There must be a great majority of good botanical teachers whose chief interest is the development of the teaching aspect of the science, and whose effort is legitimately expended in this way. To such Ganong brings a message.

FRANCIS ERNEST LLOYD
ALABAMA POLYTECHNIC INSTITUTE

[1] This report is printed as an appendix.

Lehrbuch der anorganischen Chemie. Von Professor Dr. H. ERDMANN, Direktor des Anorganisch-Chemischen Instituts der Königlichen Technischen Hochschule zu Berlin. Fünfte Auflage. (Dreizehntes bis Sechszehntes Tausend.) Mit dem Porträt des Verfassers in Gravüre, 319 Abbildungen, 95 Tabellen, einer Rechentafel und Sieben Farbigen Tafeln. Braunschweig, Friedrich Vieweg und Sohn. 1910. Pp. 805. 16 Marks.

A new edition of "Erdmann" will be welcome to every chemist who has read the earlier editions. This book is well known but not as well as it deserves. When the first edition appeared thirteen years ago, it was recognized as the best existing one-volume text-book of descriptive chemistry; each succeeding edition is an improvement on its predecessor.

The present fifth edition has a melancholy interest as the last work of the author. Erdmann wrote the preface but a few days before his accidental death by drowning while sailing on a lake near Berlin. He was an active worker in several fields of chemistry, but will be best remembered for the "Lehrbuch."

What are the chief features of this book? It is written for advanced students, not for beginners. It is essentially descriptive. It opens with a condensed but admirably clear and complete statement of physical-chemical laws and methods contained in an introduction of 84 pages. The remainder of the book treats of the elements and their compounds, and is chiefly descriptive, both chemical and physical properties being considered; technical methods and experiments profusely illustrated by excellent diagrams form a prominent feature of the book.

To give the reader an idea of the scope of the book, the headings of the paragraphs of one of the shorter and simpler chapters may be given. It is worth the reader's attention. The chapter on hydrogen fills 21 pages; it includes 4 tables, 22 diagrams and a beautiful colored plate of the spectra of hydrogen, oxygen and nitrogen. The chapter begins with the present and the old names of the element in German and the present name in English, French, Russian and Spanish. The physical constants follow; then the following paragraphs—occurrence in the universe; on the earth free and combined; relative weights of chief elements in earth's crust compared with relative number of their atoms; discovery; preparation; hydrogen as by-product; as unit of gas densities; free hydrogen has the density 2; specific gravity of hydrogen compared with air and with water—determinations of Regnault, Rayleigh, Cooke, Leduc, Morley and Thomsen; normal pressure and normal temperature; polarization; molecular speed; diffusion; effect of change in temperature and pressure on expansion; hydrogen the legal basis of thermometry; Kelvin's phenomenon; liquid hydrogen; critical pressure; chemical activity; action on water, on the halogens; on oxygen; combustible; metallic modification of hydrogen; nascent state; as unit of atomic weights; density in palladium alloy compared with densities of alkali-metals; as reducing agent; practical uses; lifting capacity of balloons; filling balloons; hydrogen as fuel; spectrum. Then follows the section on experiments and technique with the diagrams. In addition to the familiar apparatus and experiments may be mentioned Bucher's apparatus for quick generation of large volumes of hydrogen from aluminium and sodium hydroxide, or from calcium hydride (hydrone); Kammerlingh-Onnes's apparatus for liquefying hydrogen; the triple-walled Weinhold modification of the Dewar flask; experiments with liquid and with solid hydrogen; griessheim process for preparation of large quantities of hydrogen.

Not only do we find matter in this book which is not given in other one-volume text-books, but we find something new concerning nearly every element and important compound which was not in the last edition, for the author introduced a reference to every important discovery if it appeared in the journals before the edition went to press.

The elements are treated in the main in the order of the periodic system, though Erdmann makes but little use of the system, describing it in the closing chapter. His own arrangement of the elements in a spiral curve—given on a separate table—is interesting.

A singular flaw in the book is the lack of a proper treatment of the subject of steel. The data given are scant, scattered and empirical. Thus vanadium steel is barely mentioned and only in the chapter on vanadium. This is, however, but a small matter compared with the general excellence of the book. Translations are not known to the reviewer. The frequent appearance of new editions has probably de-

terred translators. The cost of adequate production might deter publishers. Most of those who need a book of this kind would prefer to use the original.

The publishers of the book have used a thin, tough, opaque paper and a close clear type, thus bringing into one volume of readable size matter which with other paper and type would fill two volumes. The diagrams and particularly the colored spectra plates are very fine. The price of the book is comparatively very low.

E. RENOUF

Sewage. By A. PRESCOTT FOLWELL. Sixth Edition. 8vo, pp. 506, cloth. New York, John Wiley & Sons. $3.00.

The first 358 pages of this new edition are devoted to detailed descriptions and directions for the design, construction and maintenance of sewers and their various appurtenances, as used for the removal of those wastes that are conveyed from the household by water-carriage in underground channels. The book is a comprehensive one in this respect, serving not only as a useful guide to the student in sanitary engineering, but also as a valuable reference book to the practical engineer and the sanitarian.

Specifications, forms of contract and procedures for putting such work under contract are given in a manner to engage the attention of the city official. Cost data are analyzed with much detail and should prove of interest to engineers and contractors.

Since the first edition of this book appeared eleven years ago, there have been a number of features which have arisen for discussion, and these have been judiciously embodied in the sixth edition. From the strictly engineering standpoint, they relate particularly to the use made of concrete.

The chapters on the ventilation and flushing of sewers are well prepared. They wisely advocate the construction and operation of sewers so as to keep as fresh as possible both the sewage itself and the air within the sewers. The importance of guarding against putrefaction in sewers and sewer-connections is becoming more and more appreciated, particularly by those who have to do with sewage purification. It is gratifying to note that the old idea of trapping the main house drains is not favored, but preference is given to ventilating the street sewers through the house connections with pipes extending to above the roofs, as is the custom on the continent of Europe. The discussion of this subject should prove of interest to sanitarians.

Pages 359–492 are devoted to the subject of sewage disposal and have been practically rewritten. All the principal aspects of sewage disposal by dilution and by treatment in works of artificial construction of various types are well outlined. The book is not intended to be an exhaustive treatise on sewage disposal, but it is a well-balanced review of the subject which will prove serviceable to students in sanitary science, as well as to health officers, city officials or others interested in the general subject.

The book has been brought well up to date, as is shown by the statements given with respect to the Emscher tanks for the clarification of sewage as recently practised in western Germany with a marked degree of success, showing much improvement over the so-called "septic tanks."

The point of view that prevails generally throughout the closing chapters of the book is a practical one. Experiences with sewage disposal on a large scale are used frequently in illustrating methods and processes.

Without doubt, the enlarged edition of this book should prove very useful in the class-room and in the library of those who are interested in the advancement of sanitary science. The book is well edited and indexed, and it contains 46 illustrations and 31 tables.

The arrangement of the book for class-room use will doubtless appeal to teachers, as it shows the results of Professor Folwell's successful experience for some years as head of the department of civil engineering of Lafayette College, prior to his taking the editorship of the *Municipal Journal and Engineer.*

GEO. W. FULLER

SCIENTIFIC JOURNALS AND ARTICLES

The opening (January) number of volume 12 of the *Transactions of the American Mathematical Society* contains the following papers:

L. E. Dickson: "An invariantive investigation of irreducible binary modular forms."

W. H. Bates: "An application of symbolic methods to the treatment of mean curvatures in hyperspace."

H. F. Blichfeldt: "On the order of linear homogeneous groups (fourth paper)."

J. L. Coolidge: "The metrical aspect of the line-sphere transformation."

Edward Kasner: "Natural systems of trajectories generating families of Lamé."

L. E. Dickson: "A fundamental system of invariants of the general modular linear group with a solution of the form problem."

R. D. Carmichael: "Linear difference equations and their analytic solutions."

The February number (volume 17, number 5) of the *Bulletin of the American Mathematical Society* contains: Report of the fourth regular meeting of the Southwestern Section of the society, by O. D. Kellogg; Report on "University courses in mathematics and the master's degree," by the American sub-committee of the International Commission on the Teaching of Mathematics; Review of Doehlemann's Geometrische Transformationen, zweiter Teil, by Virgil Snyder; Shorter Notices: Sylvester's Collected Papers, Vol. III., and Bachmann's Niedere Zahlentheorie, zweiter Teil, by L. E. Dickson; Burali-Forti and Marcolongo's Eléments de Calcul vectoriel, by E. B. Wilson; Lebon's Gaston Darboux, by J. W. Young; Killing and Hovestadt's Handbuch des mathematischen Unterricht's, by D. D. Leib; Amodeo's Analisi algebraica elementare, by C. L. E. Moore; Rietz and Crathorne's College Algebra, by J. V. McKelvey; Planck's Prinzip der Erhaltung der Energie, second edition, by E. B. Wilson. "Notes"; "New Publications."

The March number of the *Bulletin* contains: Report of the seventeenth annual meeting of the society, by F. N. Cole; Report of the winter meeting of the Chicago Section, by H. E. Slaught; Report on "Preparation for research and the doctor's degree in mathematics," by the sub-committee of the International Commission on the Teaching of Mathematics; Shorter Notices: Frankland's Theories of Parallelism, by D. E. Smith; Vogt's Synthetische Theorie der Cliffordschen Parallelen, by E. B. Cowley; Bruns's Gruppenschema für zufällige Ereignisse, by H. L. Rietz; W. W. Johnson's Elementary Treatise on the Differential Calculus, by E. W. Ponzer; Becker and Van Orstrand's Hyperbolic Functions, Fabry's Problèmes et Exercices de Mathématiques générales, and Couturat's Internacione matematikal Lexiko en Ido, by J. B. Shaw; Richarz's Anfangsgründe der Maxwellschen Theorie, by E. B. Wilson. "Notes"; "New Publications."

THE FIFTH ANNUAL REPORT OF THE PRESIDENT OF THE CARNEGIE FOUNDATION

President Pritchett's annual report gives a full and clear statement of the business of the Carnegie Foundation for the Advancement of Teaching during the year ending November 30, 1910, and includes an essay on the relations of colleges and secondary schools.

The University of California, Indiana and Purdue Universities, and Wesleyan University have been added to the accepted list of the foundation. The two state universities—for Indiana and Purdue form together essentially one state university—obviously meet standards which allow the admission of colleges such as Beloit, Carleton, Coe, Dickinson, Drake, Drury and Knox. The tax-supported universities previously admitted are Michigan, Wisconsin, Minnesota, Missouri and Toronto. It seems to the present writer most unfortunate that the executive committee of the foundation should prescribe to the state universities what they must do in order to receive pensions. Illinois has been told that it must break the agreement which it made with the professors of the medical school in Chicago; Ohio that it must reconstruct its educational policy, and the like. It is to be hoped that those in control of the state universities will resent such dictation. Indeed one can not altogether dismiss the suspicion that the

officers of the foundation have the same hope, in order to be released from obligations which they could not meet.

Wesleyan University has amended the charter which made it ultra-denominational—for it required not only the president and a majority of the trustees, but also a majority of the professors to be members of the methodist episcopal church—and although one fourth of the trustees are elected by the conferences of the church, it has complied with the rules of the foundation. Other institutions which are altering or trying to alter their church affiliations should know that the foundation will be very cautious in assuming further financial responsibility.

This appears to be at last clearly acknowledged by the president and the executive committee. The president makes the acknowledgment retroactive when he writes:

> In every report issued by the Carnegie Foundation, the effort has been made to call the attention of colleges and universities to the fact that the endowment in the hands of its trustees would provide at most an adequate retiring allowance system for only a small minority of the institutions in the United States and Canada bearing the name college or university. This was most strongly urged even in the First Annual Report.

But in his first annual report, President Pritchett estimated that with the original endowment the foundation could accept from one hundred to one hundred and twenty institutions,[1] including payment of pensions for length of service. He wrote:

> It may therefore be safely assumed that while the income of the Foundation is sufficient to carry out the original plan of the Founder it is not sufficient to extend the system of pensions, at least at first, beyond the scope which he indicated in his letter of gift. It would seem therefore clearly the true policy of the Trustees at the inauguration of the Foundation to work within these limits, giving a generous interpretation to the terms "sectarian" and "state" control.

In his letter of gift, Mr. Carnegie wrote: "Expert calculation shows that the revenue will be ample" "to provide retiring pensions for the teachers of Universities, Colleges and Technical Schools in our country, Canada and New Foundland."

The state of the finances of the foundation is shown in the report of the treasurer, from which it appears that the receipts for the year were $543,881 and the expenditures $538,148, leaving a surplus income less than $6,000. The obligations undertaken for the current year leave a deficit of nearly $100,000. This will doubtless be met from the income of the further five million dollars which Mr. Carnegie has consented to give for tax-supported institutions. He wrote to the president of the foundation on March 31, 1908: "I understand from you that if all the State Universities should apply and be admitted Five Millions more of five per cent. bonds would be required." But there are eighty-three institutions supported by states and provinces, of which but eight have as yet been admitted to the accepted list of the foundation.

If such of these institutions are accepted as fulfil the educational requirements originally set by the foundation, the income next year would not meet the expenses, and thereafter the deficit will increase at a rate not less than $100,000 a year. It will be necessary for Mr. Carnegie to give at least two million dollars each year in order that the income may meet the increased charges.

Under the circumstances it is not surprising that the executive committee has voted that

> it is not expedient in the future to grant retiring allowances outside of the accepted list, except in cases of especial significance in institutions whose standards are so advanced that within a short time the institution will be ready to apply for admission to the Foundation.

How incompletely even such a great gift as Mr. Carnegie's establishes a pension system for higher education throughout the country is illustrated by the fact that Knox College is the only institution accepted in the state of Illinois and Tulane the only institution south of Maryland and Missouri.

The financial inability of the foundation obviously accounts for the discontinuance of

[1] More than existed, having the educational standards required by the foundation, and being non-denominational and non-tax-supported.

the length of service pensions. What needs explanation is why they were established, why they were discontinued in the manner adopted and why they were not paid to those to whom they had been promised. Suppose that Mr. Carnegie in order to get better domestic servants and at lower wages had promised that those who wished could retire after twenty-five years of service with half wages. If he found that the arrangement did not work well or that he did not have enough money to keep up his establishment, he might very well have employed no new servants on these terms. But would he have broken his engagement with those who had served part of the time; and, if so, what would have been the decision of the courts if suit had been brought?

In his report Dr. Pritchett dismisses the breaking of the pledges of the foundation lightly with the single remark:

> The experience of the year has confirmed in the judgment of the trustees the wisdom and essential justice of the action taken a year ago.

Now this is a truly remarkable, indeed an almost incredible state of affairs. The present writer has discussed the matter with some two hundred university professors in the course of the past year, and so far as he remembers not a single one of them regarded the action of the trustees as other than unwise and unjust. In the act of incorporation the objects of the foundation are stated to be to provide pensions of two kinds: (1) for long and meritorious service and (2) for old age, disability or other sufficient reason, and further "to do and perform all things necessary to encourage, uphold and dignify the profession of the teacher and the cause of higher education." In the method used to give up the pensions for length of service the foundation has certainly not fulfilled the obligations specified in the second part of its charter.

It is obvious that unless Mr. Carnegie greatly increases the endowment of the foundation it can not meet its present obligations. They obtain most of all in the case of the younger men now entering the academic career in view of its promises. It will doubtless be necessary to give up the retiring allowances, for age and confine them to disability. The present writer does not regret this, for reasons which he has fully stated (Science, April 2, 1909).

Retirement at the age of sixty-five has substantially the same drawbacks as retirement after twenty-five years of service. Men who are less competent or who are not in favor with the administration will be retired; and instead of security and loyalty, there will be unrest and bitterness. The president will be quick to retire professors because their pensions are not paid by his institution, but from an outside source. There is no more reason for retiring professors at sixty-five than justices of the supreme court. There should be pensions (or still better full salaries after long terms of service) for disability, but these should be paid by the university. It would have been far better if the Carnegie Foundation had given its income as an endowment to one institution after another for the establishment of a pension system. Its present financial difficulties would have been avoided, and the dangers of a centralized autocracy would have been escaped.

It is to be hoped that when the trustees of the foundation abandon the retiring allowances at the age of sixty-five years, they will do so in a manner that will "encourage, uphold and dignify the profession of the teacher and the cause of higher education."

J. McKeen Cattell

SPECIAL ARTICLES

THE TYPE OF COLUMBINA SPIX

A few years ago I discussed the question of *Columbina vs. Chæmepelia* in *The Auk*,[1] contending that the designation of *Columba passerina* Linn. by Gray in 1840 as the type of *Columbina* was valid, and that his later designation of the same species as the type of *Chæmepelia* rendered *Chæmepelia* (Swainson, 1827) a synonym of *Columbina* (Spix, 1825). The genus *Columbina* originally contained four species, all described as new, one of

[1] Vol. XXV., 1908, pp. 301–306.

which (*griseola*) proves to be only a slightly differentiated subspecies of *C. passerina*. For many years, or until the custom came in of recognizing subspecies, the real status of *griseola* was that of a synonym of *passerina*, which up to a recent date[2] had a commonly recognized range extending from the warmer parts of the United States south through the West Indies, Central America and South America to Paraguay and Peru, thus including the type locality of *griseola*. When the original *passerina* came to be divided into numerous subspecies, *griseola*, as recognized by recent leading authorities, became *Chæmepelia passerina griseola*.

In my paper cited above I stated that I could "see no reason why *Columbina griseola* = *Columbina passerina griseola* (Spix) may not be properly taken as the type of *Columbina*, in accordance with rule *d* of Art. 30 of the International Code respecting the equal availability of species and subspecies as types." I find it is now questioned whether this statement, owing to its form, can be taken as really designating a type for *Columbina*, and take this opportunity of stating that this was its intention. To leave no doubt, I may here add: *Columbina* Spix, 1825; type *C. griseola* Spix = *Columbina passerina griseola* Spix.

But there are other complications hovering about the type of *Columbina*, and about the propriety of the above designation, on the ground that the question is one partly of zoology and partly of nomenclature. In other words, that *griseola* may not be a subspecies of *passerina* but possibly a distinct species, or a subspecies of some other species. This question could not well have arisen except for a mistake made by Bonaparte, in 1854, and followed by nearly all authors for the next half century. He recognized and described a species under the name "*griseola* Spix" which was not only *not* the *griseola* of Spix but bears to it no very close relationship, it being in reality the *Columba minuta* of Linnæus. To this extent, and no further, is the type of *Columbina* a question of zoology; for the type of *griseola* Spix is still extant and proves to be a young female of the *passerina* group, or of "*passerina*" as formerly recognized.[3]

J. A. ALLEN

[2] Cf. Salvadori, Brit. Mus. Cat. Birds, XXI., 1893, p. 477.

[3] Cf. Hellmayr, Abhandl. d. II. Kl. d. k. Akad. Wiss., XXII., Abb. iii, 1906, p. 697.

ANOTHER SEX-LIMITED CHARACTER IN FOWLS

IN view of the number of sex-limited characters recently recorded, the report of another one may be of interest even though the experiment has not yet gone beyond the first generation.

The Brown Leghorn fowl has nearly the same color as the wild *Gallus bankiva*. It is a sexually dimorphic breed, with black and reddish or yellowish-bay the chief colors in the male, and with the female lighter in color and showing a characteristic black and yellowish-brown pepper-and-salt pattern on the back and wings. The Columbian Wyandotte has both sexes white, with black in the neck, wings and tail.

When these two breeds were crossed there were three different classes of birds in the F_1 generation. There were brown females resembling the Brown Leghorn females, and gray males and females resembling the Columbian Wyandottes but having considerable black mixed with the white ground color, thus giving a grayish effect. These came in the following way:

Brown Leghorn ♂ + Columbian Wyandotte ♀
= 10 gray ♂ and 8 brown ♀.
Columbian Wyandotte ♂ + Brown Leghorn ♀
= 9 gray ♂ and 3 gray ♀.

It will be seen that these results agree with Goodale's experiment,[1] since the gray males show considerable red or brown on their backs, as was the case with the corresponding birds in his cross between White Rocks and Brown Leghorns.

The gray females, however, unlike his barred F_1 females, also show a little brown, though this is not conspicuous. They also show some

[1] *Proc. Soc. Exp. Biol. and Med.*, Vol. 7, No. 5, May 18, 1910.

of the Brown Leghorn pepper-and-salt pattern. The F_1 brown females are yellower on the fore part of the back and wings than are the Brown Leghorns. They seem to resemble some of Goodale's F_1 brown females, but none are as dark as some of his. Perhaps such would have appeared if a larger number had been raised.

These results show that the gray pattern behaves as the barred and brown ones have already been shown to do. The results may be explained as the others are. Represent the gray factor by G, the brown by B, and femaleness by F. Assume that both G and B are spurious allelomorphs to F.[2]

The representation will be

Brown Leghorn ♂ — gBf gBf
Columbian Wyandotte ♀ — Gf gF

produce { gBf Gf — gray ♂.
gBf gF — brown ♀.

Columbian Wyandotte ♂ — Gf Gf
Brown Leghorn ♀ — gBf gbF

produce { Gf gBf — gray ♂.
Gf gbF — gray ♀.

Nothing has yet appeared to show the composition of the Columbian Wyandotte with regard to B.

Several years ago a Columbian Wyandotte male was mated to a female of the Silver Laced Wyandotte breed, which has black wherever the Columbian has it and also has the feathers of the back, breast and shoulders white, edged or laced with black. The F_1 birds were nearly typical Columbians, one of the males being near enough to that color to win a prize as a Columbian at a poultry show. Some of the females, however, showed black edging on the tips of some of the feathers of the back. One of these was mated to a Columbian Wyandotte male, and the result was practically the same as in the F_1 generation. Unfortunately, this cross was not made in the right direction to bring out the sex-limited character, but the result agrees well with that described above.

A. H. Sturtevant

Columbia University,
January 2, 1911

[2] Goodale's work (mentioned above) has shown that B is sex-limited.

The American Association for the Advancement of Science

The Forty-third General Meeting of the American Chemical Society and Section C

The forty-third general meeting of the American Chemical Society and Section C of the American Association for the Advancement of Science was held at Minneapolis in the Chemistry Building at the University of Minnesota, December 28–31, 1910. The first general meeting was called on Wednesday morning.

About 300 members and guests registered for the meeting. Approximately 275 of these were members of the society. The meeting was a thoroughly good one from the consideration of attendance, number and quality of papers, and the generally good time which every one enjoyed because of the generous hospitality of our hosts.

The council of the society met on Wednesday afternoon and Thursday evening, when the general business and election of officers were considered.

Wednesday evening the Minneapolis Section of the society extended a complimentary smoker to the visitors at the Commercial Club. Complimentary luncheons were also prepared for the visitors during each day of the session.

On Thursday and Friday afternoons excursions were made to the Minneapolis flour mills, International Stock Food Factory, St. Anthony Falls Power Company, the linseed oil and paint companies. On Saturday afternoon the visitors enjoyed a free excursion to the many points of interest about Minneapolis and St. Paul.

The following papers and addresses were given before the general meetings:

"A Universal Law," President W. D. Bancroft.

"Report for the International Committee on Atomic Weights," F. W. Clarke.

"The Lost Arts of Chemistry," W. D. Richardson.

"The Basis of Industrial Efficiency," Arthur D. Little.

"Synthetic Metals from Non-metallic Elements," Herbert N. McCoy.

"Progress in Food Chemistry," H. E. Barnard.

"Mechanism of Cell Activity," Carl L. Alsberg.

"Waste Wood and some of its By-products," Geo. B. Frankforter.

"The Formation of Carbohydrates in the Vegetable Kingdom," Wm. McPherson.

"The Efficiency of the College Graduate in the Chemical Industry," Chas. F. Burgess.

BIOLOGICAL SECTION

Carl L. Alsberg, *chairman*
I. K. Phelps, *secretary*

The Lecithin Content of Milk under Pathologic Conditions: L. W. FETZER.

The results show that milk obtained from animals suffering from mastitis contains less lecithin than the milk obtained from healthy animals. It was further noted that where a diminution in the lecithin content took place there was a corresponding decrease in the fat content.

The Antitoxic Action of Certain Nutrient and Non-nutrient Mineral Bases with Respect to Plants: M. M. MCCOOL.

Extensive data were presented with reference to antagonistic action of different bases with respect to plants. In the experiments reported the Canada field pea has been made the indicator, and a complete comparative study has been made of the growth of tops and roots in solutions of the different bases as follows: (1) solutions containing single bases in concentrations varying from those which are non-toxic to those which practically prohibit growth; (2) solutions containing two bases at concentrations including those toxic when employed alone.

It was found that mutual antagonism occurs in the following combinations:

Ca *vs.* Ba	Ca *vs.* NH_3
Ca *vs.* Fe	Ca *vs.* Sr
Ca *vs.* K	K *vs.* Sr
Ca *vs.* Mg	Na *vs.* K
Ca *vs.* Mn	Na *vs.* Mn
Ca *vs.* Na	Na *vs.* Sr

To express the above in terms of single antagonism, it is obvious that the second term in each of these systems could be placed first, but the arrangement given indicates that the base first given is the most important term in the combination with respect to antagonistic action.

The toxicity of the various bases in distilled water, full nutrient solutions, and soil cultures have been determined likewise as additional controls upon the preceding results. The tests of all of these bases in dilute nutrient solutions of any type, or in soil or sand cultures, diminishes or prevents the injurious action of the concentrations toxic in water.

The Oxidative and Catalytic Powers of Soils and Subsoils: M. X. SULLIVAN and F. R. REID.

Surface soils have the power to oxidize easily oxidizable substances such as aloin, guaiac, pyrogallol, hydroquinone, etc. When ten grains of soil are shaken with 50 c.c. of a 0.1 per cent. water solution of aloin, the yellow color of the aloin is changed to cherry red. On allowing the soil to settle, the solution can be filtered and the depth of color determined in the colorimeter. Broadly speaking, the oxidative power of the soil is symptomatic of a good soil condition, since soils of good productivity have in general good oxidizing power, while soils of poor productivity have, as a rule, poor oxidizing power. Subsoils have little, if any, action on aloin, though occasionally the oxidizing power of the subsoil may be as great or greater than the corresponding surface soil. The catalytic power of the soil or its capacity for decomposing hydrogen peroxide with the liberation of free oxygen is roughly parallel to the oxidative power in that soils known to be of good productivity have strong catalytic power, while poor soils have weak catalytic power. As compared with surface soils, the subsoils have, for the most part, a weak catalytic power. The oxidative and catalytic powers of the soil are analogous to these powers in plants and animals and are modified in much the same way.

Enzymotic Activities in Soils: OSWALD SCHREINER and M. X. SULLIVAN.

Within the bodies of microorganisms in plant roots and plant débris, in worms and animalcules, enzymes of various kinds must exist. Evidence of various enzymotic activities, proteolytic, amylolytic, inverting, cytolytic, lipolytic, etc., may be seen in many soils. Starches, sugars, cellulose, fat and protein are speedily changed or disappear, and in many cases, especially of proteins, some of the products of digestion may be found in the soil. The oxidizing and catalytic activities of the soil, comparable to the same activities in plants and animals where it has been attributed to enzymes, is especially noticeable and easy of demonstration. As yet no satisfactory means have been obtained of extracting enzymes from soil to any great extent, though in soils recently cropped there is some slight evidence of the presence of enzyme-like substances in the glycerine extract of the soil.

Soil Organic Matter as Material for Biochemical Investigation: OSWALD SCHREINER and EDMUND C. SHOREY.

Attention is called to the complexity of the organic matter of soils and the fruitful field of research that it offers for biochemical investiga-

tion. The importance of the chemical character of the organic matter of the soil is considered under four heads: its effect on crops; its effect on the bacteria and fungi of the soil; its influence on the physical properties of the soil, and its relation chemically to the mineral ingredients of the soil. By the application of the biochemical methods there have been isolated in this research twenty definite organic compounds thus far from that portion of soil organic matter included in the term humus. A chart showing the classification of these compounds, as well as methods of separation, was shown. The compounds comprised paraffin hydrocarbons, acids, alcohols, esters, carbohydrates, hexone bases, pyrimidine derivatives and purine bases.

The Isolation of Creatinine from Soils: Edmund C. Shorey.

Creatinine has been isolated from several soils by the following method. An extract made by shaking the soil for half an hour with 2 per cent. sodium hydroxide was neutralized with acetic acid and filtered. To the filtrate a small quantity of dextrose was added, heated to boiling, and Fehling's solution added until the precipitate formed was red in color. The precipitate after washing was decomposed with hydrogen sulphide and the filtrate from the copper sulphide concentrated under reduced pressure. Creatinine, if present in the soil, is in this filtrate together with purine bases and can be separated as creatinine zinc chloride and creatinine prepared from this by treatment with lead hydroxide. The creatinine was identified by the characteristic crystalline appearance of the zinc chloride compound and by the Jaffe, Weyl and Salkouski color reactions.

The Toxic Action of Organic Compounds as Modified by Fertilizer Salts: Oswald Schreiner and J. J. Skinner.

The action of fertilizer salts in restraining the harmful influence of certain organic compounds was studied, as well as the effect of the compounds on absorption. The culture solutions comprised all possible ratios of the three principal fertilizer elements: phosphate, nitrate and potassium, varying in 10 per cent. stages.

The various fertilizer salts acted differently in overcoming the respective harmful effects of the toxic compounds. The mainly phosphatic fertilizers were the most efficient in overcoming the cumarin effects; the mainly nitrogenous fertilizers in overcoming the vanillin effects; the mainly potassic in overcoming the quinone effects.

The cumarin depressed potash and nitrate removal from nutrient solution more than phosphate; the quinone, on the other hand, depressed phosphate and nitrate more than potash; the effect of vanillin was not determined in this regard. It is interesting to mention that dihydroxystearic acid, which, as previously reported, appears to act much as vanillin did, depressed phosphate and potash more than nitrate. In this respect again the influence of the various harmful substances was different.

The conclusion is drawn that different toxic substances produce definite effects in their action on plants and that the effects are modified differently by the different fertilizer salts.

On the Catalase Content of Tissues and Organs after Prolonged Fasting: P. B. Hawk, Laboratory of Physiological Chemistry, University of Illinois.

The study embraced the examination of the tissues and organs of four dogs which were subjected to periods of fasting ranging from 7 to 104 days. A pup one month old was subjected to a 7-day fast, a dog from one to two years old served as the subject of the 30-day fast, whereas the longer fasts were carried out upon mature animals. The dogs were fed a constant water ration, the water being introduced by means of a stomach tube.

At the termination of the fasting periods chloroform-water extracts of the tissues and organs were prepared and their catalase values determined. The tissues and organs of normally nourished dogs were subjected to a similar examination in order to secure data for comparative purposes.

The catalase values of the fasting tissues and organs are much lower, in every instance, than those of the normal tissues and organs. It was also observed that the order of the tissues when arranged according to their catalase content is distinctly altered in the fasting animals from the order in force under normal conditions. There is apparently no uniformity as to the specific alterations which take place in the catalase content of animal tissues and organs under the influence of fasting. The data obtained from the four fasting animals under consideration are in every case different from normal catalase values, but at the same time these catalase values obtained from fasting animals exhibit marked variations when we make a comparison of the data from the four animals under investigation. It is of particular

Catalase Values

Dog	Tissue								Days
	Liver	Kidney	Spleen	Lung	Heart	Muscle	Brain	Pancreas	
Normal.....	67.1	66.4	8.8	7.2	4.3	2.7	0.8	0.7	
Fasting	52.7	50.4	5.1	10.8	2.6	0.0	8.2	0.5	104
Fasting	23.8	4.4	0.0	8.2	0.0	0.0	0.0	0.0	48
Fasting	34.8	46.5	0.0	0.5	0.0	0.0	0.0	0.0	30
Fasting	57.0	11.1	...	1.2	12.3	0.0	0.0	0.0	7
	Relative Order of Tissue								
Normal.....	Liver	Kidney	Spleen	Lung	Heart	Muscle	Brain	Pancreas	
Fasting	Liver	Kidney	Lung	Brain	Spleen	Heart	Pancreas		104
Fasting	Liver	Lung	Kidney						48
Fasting	Kidney	Liver	Lung						30
Fasting	Liver	Heart	Kidney	Lung					7

interest that the tissues and organs of the dog which was subjected to the most prolonged period of fasting exhibit less alteration from the normal than do the tissues and organs of those animals which were subjected to much shorter fasts.

Demethylation in the Body: WILLIAM SALANT and I. K. PHELPS.

Determinations of the urinary purins precipitable by copper sulphate in sodium bisulphide after the administration of caffein indicate that individuals of the same species vary considerably in their power to demethylate this substance. The amounts of purin nitrogen obtained from the urine of two dogs when a total of four hundred milligrams caffeine per kilo were given in eight days were eight and thirty-two milligrams purin nitrogen per kg. After feeding three hundred milligrams caffeine per kilo to these animals during the next four days eight and twenty-two milligrams purin nitrogen per kilo were obtained. After an interval of eight days the administration of caffeine was resumed and much greater amounts of purin were found in the urine. In one case the amount of purin per kilo was increased two hundred per cent., although the amount of caffeine given was only twenty per cent. greater. In the other dog the increase of purin nitrogen was sixty per cent. greater; the amount of caffeine in this case was likewise increased by twenty per cent. It was further observed that demethylation remained relatively unchanged when the caffeine was given daily.

Some Experiments on the Influence of the Digestive Process on the Excretion of Carbon Dioxide: G. O. HIGLEY.

The apparatus used in this work was the balance-chemograph.

The food employed was one half a pound of broiled beef-steak at each meal. The four subjects were students in the University of Michigan. No food was taken by the subject during the five hours preceding an experiment. The subject reclined for fifteen minutes, then the "normal" was determined. The food was now eaten and fifteen minutes thereafter, and at regular intervals, determinations of the carbon dioxide excretion were made.

The maximum increase over the normal was twenty-five per cent. in one case and only 7.7 per cent. in another case.

The promptness of the increase was also quite different, the increase over the normal being at the end of thirty minutes, 1.2 per cent., 7 per cent. and 11.9 per cent., respectively, in the case of three subjects.

The Incompatibility of Alcohol with other Nutrients: J. E. SIEBEL, JR., M.D.

The incompatibility as subject of this paper refers to a certain incompatibility with nutrients, especially in persons constitutionally affected, which is due to the fact that the human system, having a choice, disposes first of alcohol before other nutrients are affected in metabolism, as proved by the classic feeding experiments of Atwater and confirmed by the author's researches on the electromotive force of nutrients showing a maximum result for alcohol.

Accordingly and supported by professional experience, it is concluded that for people constitutionally afflicted with disorders in which, as in arthritis and glycosuria, excesses of proteids and saccharine food are to be avoided, such excesses

are especially harmful in connection with the use of alcoholic beverages, unless special rules of nutrition, given by the author, are followed.

Improvements in the Exact Determination of Nitrogen in Feces: Isaac King Phelps.

The difficulties of an exact aliquot and of loss of nitrogen in drying the viscous material are met by each of two procedures:

The first procedure consists in dehydrating the moist mass by treatment with acidified alcohol and ether and filtration. The dry residue is then sifted and the nitrogen determined in the residual material, consisting of undigested material, in the powder obtained by sifting (which represents the residue from food) and in the alcohol-ether extract.

The second procedure consists in partially decomposing the moist material with concentrated sulphuric acid by heating in a steam bath until a homogeneous mass is produced. This is then aliquoted and the nitrogen determined in the aliquot.

The test of accuracy and adaptability of these procedures shows that they are both excellent.

The Excretion of Chlorides under the Influence of Copious Water-drinking between Meals: S. A. Rulon, Jr., and P. B. Hawk.

Three experiments were made on the influence of copious water-drinking between meals upon the excretion of chlorides. The subjects were young men ranging in age from 22 to 29 years. Each experiment was divided into three periods, a *preliminary* period during which nitrogen equilibrium was attained through the feeding of a uniform ration of low water content, a *water* period during which the uniform ration was supplemented by the drinking of large volumes of water *between meals*, and a *final* period in which the conditions of the preliminary period were in force.

In two of the experiments there was a pronounced increase in the output of chlorides upon the days of added water intake, with a return to normal during the final period. This augmented excretion of chlorides is interpreted as indicating that the large volume of water ingested during this period has markedly stimulated the secretion of gastric juice. The excess hydrochloric acid thus passed into the intestine has been reabsorbed and appears in the urine as ammonium chloride. The main bulk of the increase in the chloride excretion we believe to have originated in this way.

In one experiment there was a small increase in the chloride output upon each of the days of increased water ingestion, followed by a pronounced rise in the output upon the first day following the water period. Neither the flushing properties of the water nor its stimulatory efficiency as regards protein catabolism or gastric secretion offers a satisfactory explanation for the high chloride concentration observed upon the day following the period of copious water drinking.

If we attempt to account for the increased output of chlorides noted during the period of copious water ingestion upon the theory that this increase originated through a stimulated catabolism of protein matter within the organism, we find it possible to account for only two per cent. or less of the chloride increase on this basis.

In every instance in which a portion of the urine of each day of the water period was collected in four sub-periods three and one half hours in length it was observed that the maximum chloride output and urine volume occurred during the second period of the day, *i. e.*, from 11:30 A.M. to 3 P.M. It was also observed that the highest percentage of ingested fluid (84 per cent.) was excreted during the periods of copious water intake.

Resorption of Fat: P. F. Trowbridge, University of Missouri.

A group of seven calves six months old were selected as being of same breed and uniform in size and condition. They were fed several months until all were judged to be well fattened and all in about the same condition. The one thought to be the least fat was slaughtered and analyzed as a check animal. Two of the remaining were held at maintenance of body weight; two were fed so as to lose one half pound per day, and the other two were fed to gain one half pound per day. All were given the same feed, varying only in quantity. One of each group was slaughtered and analyzed at the end of six months, the other submaintenance animal at the end of eleven months and the other maintenance animal at the end of twelve months. The supermaintenance animal was not slaughtered, as the one half pound per day gain at his age—two years—was sufficient to make him improve in condition.

All the maintenance and submaintenance animals lost in fat. The long-maintenance animal gained in total protein and also in flesh protein. All the animals gained in weight of skeleton from 9.5 per cent. to 16.6 per cent. The skeleton of all animals gained in protein, moisture and

ash, and in fat except in that of the long submaintenance animal, which lost over 75 per cent. of its original fat. The animal on long submaintenance (eleven months) became greatly emaciated and the analysis showed that he had used up nearly all of his reserve store of fat, not only from his flesh, but from his skeleton. The short-submaintenance animal (six months) and the long-maintenance animal (twelve months) had used up nearly all the reserve fat of the tissues, but had not drawn upon the supply in the skeleton.

The loss in moisture is not sufficient to correspond to the loss in protein for a lean meat or connective tissue, which supports the view that in certain stages, at least, of fat resorption the fat is in whole or in part replaced by water.

The normal skeleton contains about 36 per cent. moisture. In the long-submaintenance animal it has risen to 53 per cent., while the fat content of the skeleton has dropped from 16 per cent. to 3 per cent. In this time the skeleton has gained nearly one per cent. of its total weight in dry protein. The long-submaintenance animal lost 10,627 grams in dry protein, but only 24,868 grams in moisture, which lacks about 16,000 grams of being enough to make up the protein loss to lean flesh and connective tissue. During this time the loss in fat was 43,829 grams, or about 90 per cent. of the total fat present at the beginning.

The Preparation and Properties of an Oxidase occurring in Fruits: FIRMAN THOMPSON and HARRY P. BASSETT.

An oxidase was prepared from the juice of pears and was found to have a marked action in the production of a tannin-like substance from gallic acid. The extent and rate of this action were measured by the precipitation of the nitrogen in a solution of egg-white. By this means a very extensive and rapid action of the enzyme was shown. Tannin determinations made by one of the standard methods also confirmed these results. It was further shown by means of plate cultures that the body thus produced exhibited marked germicidal properties.

A gradual decrease of soluble nitrogen in the juices prepared from various fruits indicates that a similar action takes place there on exposure to oxygen of the air. The writers consider it doubtful if tannin exists as such in the normal growing fruit, believing it to be rapidly formed on injury or removal from the tree, its function being to inhibit fungous or bacterial growths.

Abstracts for the following papers have not been received:

"The Iodine Content of a Physiologically Active Substance obtained from the Large, Medium, Small and Mixed Thyroid Glands of Beef, Hogs and Sheep," T. B. ALDRICH.

"The Processing of Japanese Persimmons," H. C. Gore.

"Studies on Lipoid Potassium Compounds of the Tissues," W. Koch and C. C. Todd.

"'Normal' Arsenic in the Human Body," R. L. Emerson.

"The Non-existence of so-called 'Normal Arsenic' in the Human Thyroid Gland," Wm. H. Warren.

"Nutrition Investigations, No. 30—Further Improvements in the Methods of Analyzing Flesh," A. D. Emmett and W. E. Joseph.

"A Method for the Estimation of Reducing Sugars," S. R. Benedict.

"On Luciferesceine, the Fluorescent Material Present in Certain Luminous Insects" (preliminary), F. Alex. McDermott.

"A Note on Fat Synthesis in the Human Intestine," H. M. Adler.

"On the Neutrality Equilibrium in Blood and Protoplasm. The Regulatory Activity of the Kidney," L. J. Henderson.

"Chloroform Narcosis and Fatty Degeneration in the Hearts of Nephrectomized Rabbits," F. H. McCrudden (with Paul A. Lewis).

"Further Studies on the Growth of Plants in Bacterial Transformation Products," A. Dachnowski.

"The Relation of Certain Odorous Constituents of Plants to Plant Metabolism," Frank Rabak.

"The Influence of Shade on Sugar Accumulation in Tobacco in the Tropics," H. H. Hasselbring.

"The Chromogen of the Hawaiian Bitter Yam," H. H. Bartlett.

"A Quantitative Method for the Estimation of Oxidases," H. H. Bunzel.

"The Alkaloid Content of Ergot and its Fluid Extract," A. Seidell.

"The Poisonous Properties of the Mushroom *Inocybe infida*," E. D. Clark.

"One Rôle of Carbonic Acid in Fermentation," C. H. Hudson.

"Studies upon the Biochemistry of Penicillium," O. F. Black.

"The Action of the Fungus Diplodia upon some Phosphorous Compounds of Maize," A. S. Reed.

"The Fermentation of Citric Acid in Milk," A. W. Bosworth and M. J. Prucha.

"Studies on Thermal Death-points of Milk Enzymes," W. N. Berg.

"Studies upon the Extractives of the Maize Embryo," C. L. Alsberg.

"A Rapid Method for the Production of Immune Sera," J. P. Atkinson.

"Plants which Require Sodium," W. F. V. Asterhout.

"Inosinic Acid," P. A. Levene and W. A. Jacobs.

"Yeast Nucleic Acid," P. A. Levene and W. A. Jacobs.

"The Distribution of Nuclearidases in Animal Tissues," P. A. Levene and F. Medigrecean.

Dissolved Oxygen as an Index of Pollution: Geo. A. Soper and Payne B. Parsons.

The determination of dissolved oxygen as an index of sewage pollution has been found to be reliable in the work of the Metropolitan Sewerage Commission of New York, where the quantities of sewage and conditions attending the discharge of sewage were determined and other factors in the problem known.

Opinions differ as to the permissible limit of exhaustion of oxygen by sewage. Some authorities consider that more than 30 per cent. should not be taken from the water. Others have expressed the opinion that 70 per cent. was a permissible draft. To the present authors it appears that no arbitrary standard can safely be established. A careful consideration of the local conditions should determine the safe limit for any case.

Abstracts for the following papers have not been received:

"Chemical Study of Wheat—Part 2," G. B. Frankforter and Ben Hur Kepner.

"The Composition of some so-called Malttonics," Julius Hortvet.

"The Examination of Beverages for Caffein and other Alkaloids," Edwin DeBarr.

"The Soluble Carbohydrates in Asparagus Roots," Fred W. Morse.

"The Examination of some California Alfalfa," M. E. Jaffa.

"Sugar By-products," Herbert M. Shilstone.

"Coffee and Coffee Substitute Extracts," Floyd M. Robinson.

"The Relative Toxicity of Substances added to and occurring Naturally in Foods," A. N. Cook.

"Quantitative Method for Determining Nonvolatile Oil in Cereals," E. H. Harding and Miss Lilian Nye.

Division of Agricultural and Food Chemistry

H. E. Barnard, *chairman*

B. E. Curry, *secretary*

Preliminary Report on the Loss of Lime in some Drainage Waters: A. W. Blair and S. E. Collison.

The paper describes soil investigations involving the use of fertilizers in citrus culture in progress at the Florida Agricultural Experiment Station. A description of the large galvanized iron soil tanks in use is given and rainfall records and amount of drainage water collected from the tanks for a period of three months are reported.

The lime content of seven samplings of water for the three months is given in parts per million of water, and as pounds of calcium carbonate per acre.

Some Poisons in Foods: H. E. Barnard.

A general discussion of the various poisons found in foods as preservatives and as they occur in nature.

Determination of Dissolved Oxygen in Water: Geo. A. Soper and Payne B. Parsons.

This paper reports an accurate and rapid field method for determining dissolved oxygen in water. The oxygen is determined immediately after the sample is taken.

The Determination of Arsenic in Insecticides: E. B. Holland.

The cooperation of the laboratory with the entomologist in a study of arsenical insecticides necessitated a great many determinations of arsenic. This led to a review of the literature on the subject, careful consideration of the various methods offered, and some improvements in the iodine titration method as applied to the analyses of arsenites and arsenates.

Purification of Insoluble Fatty Acids: E. B. Holland.

Finding it impossible to purchase insoluble fatty acids of a satisfactory quality, it became necessary to undertake a study of various methods for their purification.

The methods that seemed the best adapted for the purpose were (*a*) distillation of the fatty acids in vacuo, (*b*) crystallization from alcohol and (*c*) distillation of the ethyl esters in vacuo, and all were given extended trial.

It was found that while saturated fatty acids may be purified by distillation of either the acids or their ethyl esters, the latter method is less hazardous and much easier to manipulate, although more steps are required. Crystallization

is a finishing rather than an initial process of purification.

Excrement of Guayule-fed Animals: CHAS. P. FOX.

During time of drought goats feed upon the tender branches of the guayule, *Parthenum argentalum*. The leaves of this plant do not contain rubber, but there is a small amount present in the twigs. The solid excrement of the guayule-foraging animals does not contain a trace of caoutchouc.

Pingue (Colorado rubber weed) is regarded by stockmen as poisonous to sheep. In this case death is caused by clogging of the digestive organs with undigested rubber. Goats are not affected by guayule.

Dissolved Oxygen in New York Harbor: GEO. A. SOPER and PAYNE B. PARSONS.

The results of an investigation of the sanitary condition of New York harbor with respect to the dissolved oxygen is reported. The analyses were made immediately after the samples were taken.

The results show that there was not much difference between the amount of oxygen in the water at the surface and at the bottom, except that in badly polluted sections the surface samples usually contained rather less oxygen than did the deeper ones. This was contrary to expectation and is probably accounted for on the ground that the water was more impure at the top than at the bottom, a supposition supported by the fact that bacteria were most numerous at the top and by the further fact that there was more sea water near the bottom than near the top. In comparatively unpolluted sections the deep samples usually contained less oxygen than the surface samples.

When the comparatively pure sea water from the lower bay or Long Island Sound entered a polluted section, the amount of oxygen in the water of that section increased by the dilution.

Composition of the Ash of Pickles: E. H. S. BAILEY.

On account of the use of alum in the hardening of pickles the composition of the ashes of normal pickles as they appear upon the market, and also of pickles in which alum has been used, is of importance. For comparison the analyses also of green cucumbers as grown in different localities has been made. A discussion of the importance of the different constituents in the ash and the significance of the presence of these substances follows.

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

E. C. Franklin, *chairman*

S. L. Bigelow, *secretary*

Apparatus for Measuring Vapor Pressure: I. H. DERBY, F. C. GUTSCHE and F. DANIELS.

Two thrice-tubulated glass bulbs connected together by a short glass tube are filled with glass pearls and one third filled with liquid. The bulbs may be rotated horizontally on the tubes, delivering dry air and conducting away saturated air, respectively, as an axis. To each end of this axis a short rubber tube is connected and a short section of glass tubing is placed in each of the free ends of the rubber tubes. The rubber tubes are bent down and the short glass tubes fitted loosely over vertical tubes about which they may rotate as axes. Mercury contained in a cup surrounding the junction makes a gas-tight joint which yet allows rotation of the wider tubes with the bulbs.

Important features of the apparatus are: (1) simplicity of construction and operation, (2) rapid and complete saturation, (3) saturation at barometric pressure, (4) adaptability to the determination of vapor pressures of solutions and vapor compositions, for which purposes it was primarily designed.

The Nature of Mass: J. E. MILLS.

The usual idea of mass is made clear. It is shown that the modern definition of mass as expressed in the equation, $\frac{1}{2}mv^2 = m.a.s$, is not independent of, but is dependent upon, the attraction of gravitation. The attractive forces are compared, and it is shown that there is considerable reason for thinking that mass is a "gravitational charge." Facts bearing upon this suggestion are discussed.

Recrystallization of Barium Sulphate: H. C. COOPER and T. S. FULLER, Syracuse University.

By recrystallizing precipitated barium sulphate from molten sodium sulphate at 1150° and dissolving out the sodium sulphate with water they obtained crystals of barium sulphate as long as 5 mm. and as wide as 1 mm. These crystals correspond to barite, the natural crystallized barium sulphate. Equally good crystals of barium sulphate were obtained by recrystallization from molten barium chloride

The Tendency of Chemical Energy Conversion: J. E. SIEBEL, Zymotechnic Institute, Chicago.

In connection with the phase and mass law and Chatelier's theorem, the principle of the maximal work as a measure for affinity governs the tendency of chemical energy conversions.

The maximal work which is obtainable from a chemical reaction in a reversible cycle is calculable by the second law of thermodynamics, but this law, it is explained, can be more generally expressed by substituting the intensity factor by an equivalent energy factor, in which latter form, as was shown in a former paper, it is more applicable for energy conversion with saturated vapor than the former. It is now shown that the new version is also well adapted to chemical energy conversions, and that it furnishes very simple arithmetic expressions for the solutions of the problems involved.

Nucleation of Mixed Vapors in Dust-free Air: I. H. Derby.

The expansion ratios necessary to produce, in dust-free air, the formation of rain and fog, respectively, in mixed vapors of alcohol and water and mixed vapors of methyl alcohol and water have been determined for each pair of substances at varying concentrations. The series of ratios for each pair of substances show a minimum value for certain mixtures.

A tentative explanation of this behavior rests on the assumption that the molecules of one substance act as nucleation centers for the vapors of the other, due to the fact that the vapors of alcohols are charged with electricity opposite in kind to that found in water vapor.

The Rapid Determination of Silver and Cadmium by Means of the Gauze Cathode and Stationary Anode: R. C. Benner and W. H. Ross.

The study of the efficiency of the gauze electrode with a stationary anode as a rapid means for the deposition of the metals was extended to include silver and cadmium. Satisfactory results were obtained for each metal by using an electrolyte consisting of potassium cyanide in a potassium hydroxide solution. White adherent deposits were uniformly obtained in this manner. Good results, however, were not obtained when using any of the electrolytes commonly recommended for the older electrolytic methods.

The Rapid Deposition of Cobalt and Nickel by Means of the Gauze Cathode and Stationary Anode: R. C. Benner and W. H. Ross.

A study was made of the efficiency of the gauze electrode as a rapid means of depositing the metals nickel and cobalt with currents of from three to four amperes. Excellent results were obtained for each metal with the following electrolytes which were used in the older electrolytic methods—ammonium sulphate, ammonium acetate and ammonium formate, all in ammoniacal solution. In a neutral or slightly acid solution there is a tendency to anodic deposition. The results obtained with ammonium oxalate were not quite as satisfactory as with the other electrolytes named. A number of determinations were made in solutions of ammonium carbonate. This formed a most satisfactory electrolyte, either with or without the addition of ammonium hydroxide, from which to deposit these metals.

The rate at which these elements are precipitated on the gauze electrode is practically the same for all electrolytes mentioned, and, although not quite equal to the rate at which they can be precipitated when the electrolyte is agitated by mechanical means, is rapid enough for practical purposes. This method is likewise much more satisfactory because of the simplicity of the apparatus and from the fact that, if desired, the older methods with small currents may be used with the same electrodes.

The Function of the Walls in Capillary Phenomena: S. L. Bigelow and F. W. Hunter.

Experimental method and results were given demonstrating that the capillary ascension of water is measurably different in tubes of Zn, Cu, Ni, Al, Ag, Pt, glass, celluloid, beeswax and paraffin. From this fact the conclusion was drawn that, in all cases except where the maximum ascension is obtained, the ascension is a measure of the adhesion between the liquid and the walls rather than a measure of the cohesion (surface tension) of the liquid.

The capillary ascensions of saturated solutions of copper sulphate, gypsum, sodium chloride, potassium dichromate and alum were measured in tubes of platinum, of glass and of the solid solute. A regularity was discovered which may be stated as follows: The adhesion between a salt and its saturated solution is nearly the same for a number of salts irrespective of their chemical nature. The paper will appear in the *Journal of Physical Chemistry.*

The Hydrocarbons in Lignite: G. B. Frankforter and A. P. Peterson.

In this paper the hydrocarbons have been studied with the idea of isolating some of the heavier ones. The first work consisted in the proximate analyses of the lignites from the various localities, ranging from the southern to the extreme northern limits of the Dakota, Saskatchewan, Alberta and Alaska lignite belts.

An average of the distillation products in these different samples was about 50 per cent. carbon

residue, 1 to 5 per cent. of tar, 25–35 of condensed water. The gaseous products ranged from 15 to 25 liters per 100 grams of coal. The gaseous products were characterized by the very large amount of carbon dioxide they contained. It varied from 20 to 40 per cent., depending upon the locality of the lignite. There was an increase of hydrocarbons and a decrease of carbon dioxide in the gases from the lignites passing from south to north. The samples likewise resembled bituminous coal more closely from south to north.

Snow as a Means of Studying the Smoke Nuisance: GEO. B. FRANKFORTER.

In this paper snow has been used as a means of determining these constituents. After the snow had covered the ground for a given time, the amount on a square foot of ground was collected, melted and the solid matter filtered off and weighed. The solids were analyzed and finally the water was examined for the soluble solids and gases.

The amount of solid matter which fell during six weeks of winter weather in the cities of Minneapolis and St. Paul varied from .3 to 2.69 grams per square foot within the city limits. An average of ten analyses gave 1.43 grams per square foot. Calculated on the basis of one gram per square foot, there would be 43.56 kilograms per acre or 27.8 tons per square mile.

An average of ten analyses gave 57.16 per cent. of carbon and 42.84 per cent. of ash.

Average of ten analyses of the ash gave the following:

SiO_2	50.50
Ca	1.13
Mg	0.31
Fe	12.10
Al	14.26
Alkalies	1.70

The snow water was then analyzed and found to contain a considerable amount of soluble matter.

An average of ten analyses gave the following:

	Parts per Million
Total solids	39.5
Chlorine	5.1
Free ammonia	0.26
Nitrites	0.038
Organic matter (oxygen consumed)	2.49
SO_4	4.84

A New Indicator: CHAS. P. FOX.

The bark of a Congo rubber-producing vine, said to be one of the *Landolphias*, gives an aqueous extract which exhibits the properties of an indicator. Alkalies give a deep red (magenta); acids, a light yellow to colorless. Change is sharp enough for use in technical work. The aqueous preparation is unstable. The coloring substance is precipitated by acids.

A Quantitative Expression of the Periodic Classification of the Elements: FREDERICK G. JACKSON.

A chart was shown on which the atomic weights of the elements were plotted, the members of each small period being plotted on equidistant abscissæ, and an increasing multiple of 22 being subtracted from the atomic weights. The principal families of the elements were shown by connecting their members by lines. From these lines it was graphically shown that the values at present assigned to A and Te are three or four units too great, and it was suggested that Se may also be too high. Other interesting relations were indicated between different family lines.

A Simple Hydrogen Sulfide Generator: J. I. D. HINDS, University of Nashville, Nashville, Tenn.

The apparatus is in one piece. The acid is added drop by drop to the sulfid and when the stopcock in the delivery tube is closed the acid is driven immediately away from the sulfid and action ceases. Advantages: (1) the quantity of acid in generator is always small; (2) if the acid is properly added it is practically exhausted when it passes out; (3) it is cheap, economical, no waste of gas; (4) it empties itself whenever the gas is cut off; (5) the waste flows away automatically to the sink or the open air; (6) it is always ready and may be carried from place to place.

Sulfite Method for Separating and Identifying Strontium and Calcium: J. I. D. HINDS.

Principle—Barium sulfite is difficultly soluble in hydrochloric acid; strontium sulfite is difficultly soluble in acetic acid; calcium sulfite is easily soluble in both acids.

1. To a small portion of the solution (1 or 2 c.c.) add a drop of dilute hydrochloric acid, then a few drops of a concentrated solution of sodium sulfite. A white precipitate is barium sulfite and indicates barium.

2. To another small portion of the solution add a little dilute acetic acid and a few drops of sodium sulfite solution and heat to boiling. A white precipitate is barium sulfite or strontium sulfite or both. In the absence of barium, it can

only be strontium. If barium is present, it should first be removed with chromate ion.

3. If barium and strontium are absent, precipitate calcium with the sulfite without acid.

4. If strontium and calcium are present together, there are two methods of procedure:

(*a*) Add to a portion of the solution sodium sulfite and warm gently, not above 30°, shake well and filter. The calcium is almost completely precipitated while much of the strontium remains in solution. Boil a portion of the filtrate. The remaining strontium separates. If strontium is absent there is no precipitate or at least a faint cloud. Pour over the precipitate on the filter a very dilute solution of acetic acid and to the filtrate add ammonium oxalate. A precipitate is calcium oxalate.

(*b*) Make the solution acid with acetic acid, add sodium sulfite and boil. Be sure that acid is added in excess of that required to neutralize the sulfite solution which is alkalin by hydrolysis. The mixture should be but slightly acid. Shake well. Let stand a few minutes to settle, then filter, pouring the liquid through repeatedly until it is clear. Dilute a portion of the filtrate with an equal quantity of water and add ammonium oxalate. A precipitate is calcium oxalate.

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

Electrical Equipment for Electroanalysis and Electric Furnace Work: FRANCIS C. FRARY.

The author described specially designed switchboards for the distribution of the current from a storage-battery to a class in electroanalysis, and for the use of the individual students in the class. The boards are designed from the view-point of maximum efficiency and flexibility at minimum expense.

The arrangement of a 10-K.V.A. transformer for work in the furnace-room was described and illustrated. Four secondary coils are provided, two giving 10 volts and two 20. By means of copper straps these may be connected in all possible useful combinations. Five and 10 per cent. taps on the high-tension (220-volt) side of the transformer allow the increase or decrease of the voltage thus generated by 5 or 10 per cent., thus giving four possible voltages for each combination of the secondary coils. Suitable circuit-breakers are provided on both the primary and secondary sides of the transformer. Suitable measuring instruments are provided, and a large double-throw double-pole switch allows the bus-bars in the furnace-room to be connected to either direct or alternating current.

Abstracts for the following papers have not been received:

"Electric Osmose," Harry N. Holmes.

"The Effect of Continued Grinding on Water of Crystallization," Nicholas Knight.

"The Determination of Manganese by the Sodium Bismuthate Method," M. H. P. Brinton.

"The Sulfur Hydrosol Prepared by a New Method," Harrison Everett Ashley.

"The Dielectric Capacity of some Liquid Hydrides," R. C. Palmer and Herman Schlundt.

"A Case of Ammonia Deliquescence," W. P. Bradley.

"The Action of Ammonia upon Ammonium Sulfocyanide," W. P. Bradley.

"On the Electrochemical Oxidation of Hydrazine," J. W. Turrentine and Willis A. Gibbons.

"Contribution to the Electrochemistry of Hydronitric Acid: the Electrochemical Corrosion of some Metals in Sodium Trinitride Solution," J. W. Turrentine.

"Experiments on the Reliability of the Borax Bead Test for Varying Mixtures of Nickel and Cobalt," P. Rothberg and L. J. Curtman.

"A Study of the Factors Influencing the Systematic Qualitative Determination of Barium," E. Frankel and L. J. Curtman.

"Rapid Electrolytic Deposition of Metals from Boiling Solutions," Franz F. Exner.

"The Pocket Spectroscope—A Neglected Necessity for the Practical Chemist," Chas. S. Palmer.

"Physical Properties of Aqueous Solutions containing Ammonia and Citric Acid," Robert A. Hall and James M. Bell.

"The Action of Hydrogen Sulfide on certain Metallic Salts in Non-aqueous Solvents," W. G. Wilcox.

"The Heat of Neutralization of Pyridine in Various Solvents," J. Howard Mathews.

"The Use of a Dewar Flask in Measurements of Heats of Neutralization," J. Howard Mathews and A. F. O. Germann.

"Surface Tension Measurements at the Surface between two Liquids," W. D. Harkins.

"Equilibrium in the System Lead Nitrate Pyridine," J. H. Walton, Jr., and R. C. Judd.

"The Action of Oxides of Lead on Normal Potassium Tartrate," F. C. Krauskopf.

"On the Interaction of Metallic Sodium and Mercury," L. Kahlenberg and David Klein.

"The Vapor Pressure of Dried Calomel," Alexander Smith and A. W. C. Menzies.

"The Vapor Pressures of Sulfur," Allan W. C. Menzies.

"A Lower Limit for the Critical Temperature of Mercury," Allan W. C. Menzies.

"The Diffusion of Oxygen through Solids," G. B. Frankforter and R. S. Callaway.

"On the Mechanism of the Reactions of Alkyl Halides with Sodium Ethylate and with Sodium Phenolate," S. F. Acree, H. C. Robertson and E. K. Marshall.

"The Effect of certain Neutral Salts on the Hydrolysis of Ethyl Acetate at 100°," W. E. Henderson and D. R. Kellogg.

"The Violet Coloration of Ferric Alums and Nitrate," W. E. Henderson.

"Electrical Equipment for Electroanalysis and Electric Furnace Work," F. C. Frary.

"The Fluorescence of Anthracene," Wilder D. Bancroft.

"Chemical Properties of certain Radioactive Substances," B. B. Boltwood.

"Equilibrium in Carbonate Solutions," Herbert N. McCoy.

"Radioactivity of Thorium Products," Herbert N. McCoy.

"Is the Action of the Enzyme Invertase Reversible?" C. S. Hudson and H. S. Paine.

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

A. D. Little, *chairman*

F. E. Gallagher, *secretary*

Platinum Laboratory Utensils: PERCY H. WALKER, F. W. SMITHER.

The article calls attention to the fact that a great deal of platinum ware, such as crucibles, dishes, etc., offered for sale at the present time is of inferior quality, some of it being absolutely unfit for use in a laboratory.

Methods of testing platinum laboratory apparatus are described, and suggestions for a standard specification for such ware are given.

Solubility of Oxygen in Sea Water: GEORGE C. WHIPPLE and MELVILLE C. WHIPPLE.

Temperature ° C.	Distilled Water (Committee on Standard Methods of Water Analysis)	Dissolved Oxygen in Milligrams per Liter				
		Chlorine, 0	Chlorine, 5,000	Chlorine, 10,000	Chlorine, 15,000	Chlorine, 20,000
0°	14.70	14.62	13.79	12.97	12.14	11.32
5	12.80	12.80	12.09	11.39	10.70	10.01
10	11.31	11.33	10.73	10.13	9.55	8.98
15	10.14	10.15	9.65	9.14	8.63	8.14
20	9.19	9.17	8.73	8.30	7.86	7.42
25	8.35	8.38	7.56	7.96	7.15	6.74
30	7.60	7.63	6.86	7.25	6.49	6.13

Solubility of Oxygen at Different Temperatures in Water containing Different Amounts of Chlorine

From original experiments made with the Winkler method and experiments by Fox, using a method of direct absorption, a table has been prepared showing the solubility of oxygen at different temperatures in sea water and brackish waters containing different amounts of chlorine. The results in condensed form are given above.

The Work of the Chemical Laboratories of the Bureau of Mines: J. K. CLEMENT.

The chemical work is divided among a number of separate laboratories, each carrying on its own lines of work under the direction of its own chief; the whole forming a group of more or less independent units. In general, the problems of the chemists are closely connected with those of the mining and mechanical engineers.

The Fuel-testing Laboratory is occupied mainly with the analysis and calorimetric testing of fuels, including coal, coke, lignite and peat. In addition to analyzing samples of all fuels used in the boiler and gas-producer tests of the bureau, ultimate analyses and calorific value determinations are made on mine samples of coal collected by the U. S. Geological Survey, as well as by certain state geological surveys.

Fusibility and Clinkering of Coal Ash.—In the use of coal under steam boilers, the property next in importance to its calorific value is perhaps the fusibility of its ash. Indeed, some coals, which have a high heating value, are worthless for making steam on account of their tendency to clinker and adhere to the grate bars. The relation between the fusibility and clinkering properties of coal ash and its chemical and mineralogical composition is now being investigated.

Chemistry of Petroleum Technology.—The bureau is making a study of the commercial bodies contained in the crude petroleums of the United States; of the methods for their separation and purification and of their economic uses. The California fields have been selected for first study.

Combustion Investigations.—The processes of combustion in the boiler furnaces are being investigated in a furnace specially designed for the purpose.

The process of producer-gas formation is being studied from a physical-chemical standpoint, and an attempt will be made to apply, on a commercial scale, the results of laboratory experiments on the rate of formation of carbon monoxide and water gas.

The Composition of Coal.—The object of this investigation of the bureau is the isolation and identification of some of the constituents of coal.

The Volatile Matter of Coal.—The quantity and composition of the gases evolved from various coals, when heated to temperatures of from 400° to 1000° C., have been determined. In the experiments which are now in progress, particular attention will be given to the influence of the rate of heating on the character of the gases produced; to the initial composition of the gases at the instant of liberation, and to the thermal decomposition of these gases during passage over heated surfaces.

Weathering and Deterioration of Coal.—In cooperation with the Navy Department, the Panama Railroad Company and the University of Michigan, the bureau is conducting an extensive series of tests on the deterioration of various coals in storage both in the open air and when submerged in fresh water and sea water.

The Accumulation of Gas from Coal.—The quantity and rate of formation of inflammable gas from freshly mined coal, at ordinary temperatures, and the rate of absorption of oxygen by the coal have been determined.

The spontaneous combustion of coal is being investigated by the bureau. Statistical information will be combined with the results obtained in the laboratory.

The Burning of Coal in Mines under a Diminished Supply of Oxygen.—The factors governing the propagation or extinguishing of fires in mines are being investigated.

Examination of Mine Gases.—Examination is made of samples from normal mine air, from the after-damp following explosions, from stagnant areas and from burning areas during mine fires. Particular attention has been given to the detection of small amounts of carbon monoxide.

The Chemistry of Explosives.—Chemical analyses are made of all explosives submitted to the bureau for test, of the products of combustion of explosives, and of electric detonators, blasting caps and fuses.

Coal-dust Explosions.—The two greatest sources of danger encountered in mining operations are the explosive gases given off by the coal, and the finely divided coal dust which exists throughout most coal mines. The first danger can be overcome by increasing the ventilation in the mines. Unfortunately, this increases the danger from the coal dust by the removal of its moisture.

Abstracts for the following papers have not been received:

"An Improved Process for Finishing Beef Extract," J. T. Donald.

"Self-recording Efficiency," A. D. Smith.

"Efficiency in Acid Phosphate Manufacture," F. B. Porter.

"Chemistry as a Factor in Foundry Efficiency," Walter P. Schuck.

"Note on the Utilization of Lumber Waste," Jas. C. Lawrence.

"The Use of Peroxide for Silk Bleaching," W. S. Williams.

"Economical Steam Generation," C. F. Wood.

"The Importance of Eliminating Air Leaks in the Manufacture of Sulfite Acid," C. M. Ballard.

"The Spontaneous Combustion of Coal," S. W. Parr and F. W. Kressman. (Illustrated by lantern.)

"The Modern Manufacture of Portland Cement from the Chemical and Mechanical Standpoint," George P. Dieckmann. (Illustrated by lantern.)

"Errors in Determining the Sizes of Grain of Minerals and the Use of Surface Factors," Harrison E. Ashley and Warren R. Emley.

"The Utilization of Smelter Smoke in Preparing Sulfates from Clays," Harrison Everett Ashley.

"The Determination of Water in Mixed Paints," G. A. Abbott.

"Linseed Oil," A. H. Sabin.

"A Modified Process for Cane-sugar Manufacture," Harry McCormack.

"Notes on the Production and Composition of Mexican Pulque and Mescal," H. W. Rohde.

"The Importance of a Standard Temperature for Specific Gravity-determinations and for Standardizing Standard Measurings," G. W. Thompson.

"Soaps from Different Glycerides—Their Germicidal and Insecticidal Values in Themselves and when Mixed with Active Agents," H. C. Hamilton.

"Experiments on the Corrosion of Iron," W. D. Richardson.

"The Determination of Moisture in Coal," John White.

"The Disintegration of Concrete in Septic Tanks," Wm. M. Barr.

"Tensile Strength of Hair Cloth," Chas. P. Fox.

"The Exact Electrolytic Assay of Refined Copper—(1) Standard Method, (2) In Solenoid with Revolving Electrolyte," Geo. L. Heath.

"The Determination of Arsenic and Antimony in Copper, including a New Rapid Volumetric Method," Geo. L. Heath.

DIVISION OF ORGANIC CHEMISTRY

E. C. Franklin, *chairman*

Ralph H. McKee, *secretary*

No abstracts have been received.

"The Oxidation of Styrolene Alcohol," Wm. L. Evans and Lou Helen Morgan.

"The Oxidation of Propylene Alcohol," Wm. L. Evans and Edgar Witzemann.

"The Action of Ethylates on Nitrites," S. F. Acree and E. K. Marshall.

"Some Ketoester Addition Products," Richard S. Curtiss, L. F. Nickel and R. H. Lewis.

"On the Colored Salts of Nitromalonic and Dinitroacetic Esters," Richard S. Curtiss and John A. Kostalek.

"The Action of the Derivatives of Tolylhydrazines on Quinones," Wm. McPherson and George W. Stratton.

"An Important Method for the Preparation of Orthohydroxyazo Compounds," Wm. McPherson and Cecil Boord.

"Para Brom Phenyl Isoureas," Robert A. Hall.

"The Constitutions of Fucose and Rhodeose," C. S. Hudson.

"The Constitution of Dehydracetic Acid," Wm. J. Hale.

"Amine Salts of Organic Acids," J. Bishop Tingle and T. E. Layng.

"Organic Arsenic and Antimony Compounds," J. Bishop Tingle and K. Clark.

"The Action of Alcoholic Ammonia on *ab*-Dibromproprionic Acid," Wm. H. Warren.

"Tribromtertiary Butyl Alcohol," T. B. Aldrich.

"On the Constitution of the Salts of Acridine and its Derivatives," L. H. Cone.

"The Hydrocarbons in the Various Forms of Lignite," G. B. Frankforter and Andrew P. Peterson.

"The Polymerization of the Pinenes," G. B. Frankforter and Frederick Poppe.

CHEMICAL EDUCATION SECTION

C. F. Burgess, *chairman*

The Use of the Blue-print in the Teaching of Industrial Chemistry: FRANCIS C. FRARY.

Instead of the time-honored methods of showing charts or drawing diagrams of machinery on the black-board, the author recommends the use of the lantern-slide and the blue-print: the lantern-slide to be shown to the class, and a blue-print of the apparatus, made from the same negative as the slide, to be given to the student to paste in his note-book. Thus time is saved in the class-room, and the student has a better idea of the apparatus. The system was developed by Dean W. R. Appleby, of the Minnesota School of Mines, for use in the teaching of metallurgy, and the author has found it likewise helpful in the teaching of industrial chemistry and electrochemistry.

Proficiency in Qualitative Analysis: H. C. COOPER.

The results of an inquiry among prominent American chemists conducted to ascertain how students can best be prepared to make reliable analyses of miscellaneous materials were reported. It was the majority opinion that the students should be given rather extensive drill in the thorough qualitative analysis of minerals and technical products. Since qualitative analysis is generally taught to freshmen or sophomores, praiseworthy mention was given to the plan of conducting a supplementary course in the subject for the advanced students. Considerable discussion was aroused by the question of teaching students to make abbreviated analyses.

Points of View in the Teaching of Industrial Chemistry: JAMES R. WITHROW.

Defining industrial chemistry as the study of the manufacture of chemical substances and the production of commercial products with the help of chemical operations the point of view of the lecture work was taken up. Each industry is considered as a problem for the solution of the difficulties of which much work has been done and much remains to be done. The student is also made to analyze each of the industries with reference to operations involved, such as distillation, condensation, filtration, etc. These points of view give the student the desirable attitude of mind which makes him analytically critical of the industries and also makes him scrutinize the methods used to overcome difficulties in a way that makes for increased personal efficiency. With regard to the laboratory work, the usefulness of familiarizing the student with the "tools of the trade" is emphasized, but the mere requirement of such familiarity is by no means the highest object to be obtained. Emphasis is laid rather on the solution of problems in the study of cost and acquiring of data for use in works experiments on the manufacture of commercial products or utilization of by-products. The difficulties arising give the student a keen appreciation of the value to him of the library and all work, whether theoretical or practical, which is within his reach. In a word, the work is industrial research. It shows the student how to attack problems; familiarizes him with the spirit of manufacturing chemistry; gives him the proper attitude of mind toward his science; makes him

appreciative of the labor of others, and makes him conscious of the meaning of the responsibility of industrial service.

Abstracts for the following papers have not been received:

"A Laboratory Course in Chemical Engineering," W. H. Walker and Wm. K. Lewis.

"The Preparation of 'Known' Solutions in Qualitative Analysis," L. J. Curtman.

"Instruction in Physical Chemistry—Two Modifications," R. Stevenson.

"Suggestions as to Certain Desirable Changes in Chemical Nomenclature," Edwin Booth.

"Quantitative Analysis as a Science," W. D. Harkins.

DIVISION OF FERTILIZER CHEMISTRY

F. B. Carpenter, *chairman*

J. E. Breckenridge, *secretary*

The Determination of Nitrogen in Commercial Ammoniates of High Nitrogen Content. Report of the Committee on Nitrogen, Division of Fertilizer Chemists: Paul Rudnick, chairman.

Three samples were prepared, namely, dried blood, tankage and a complete fertilizer, all the nitrogen of which was derived from the same lot of dried blood. Forty-eight laboratories reported results by all the usual methods, including an average of 223 individual moisture determinations and 259 individual nitrogen determinations on each of the three samples.

The results were grouped into tables according to the methods employed. The results by the absolute or cupridoxid method were unsatisfactory and only one set of determinations by the soda lime method was received.

The individual variations from the arithmetical means in the several tables were large, but the average results of the "wet combustion" methods showed a very satisfactory agreement.

The Kjeldahl-Gunning method gave the highest results.

Special attention is called to the necessity for special precautions in the preparation and packing of samples representing shipments of these and similar commodities, in order that changes in the moisture content may be reduced to a minimum.

Abstracts for the following papers have not been received:

"The Results of Soil Investigations as Affecting the Use of Fertilizers," F. B. Carpenter.

"The Growth that Forms in Neutral Ammonium Citrate," Robert A. Hall.

"What Allowance should be made for Variation in Guarantee and Analysis of Fertilizer, and what, if any, Credit should be given a Manufacturer for an Excess in one or more of the Ingredients, to Offset a Deficiency in Another," R. E. Rose.

"Some Causes affecting the Accuracy of the Kjeldahl and Gunning Methods for the Determination of Nitrogen," Ray Henry.

"A Bacteriological Method for Determining Available Organic Nitrogen," J. M. McCandless.

"Uniform Rules and Regulations for the Admission of Ammoniates throughout the Southern States," J. M. McCandless.

"Availability of Organic Nitrogen," J. E. Breckenridge.

"The Use of Nitrate of Soda in Commercial Fertilizer," Charles S. Cathcart.

G. A. Farnham reported for the Committee on Phosphoric Acid.

J. E. Breckenridge reported for the Committee on Potash.

C. F. Hagedorn reported for the Committee on Phosphate Rock.

DIVISION OF PHARMACEUTICAL CHEMISTRY

A. B. Stevens, *chairman*

B. L. Murray, *secretary*

No abstracts were received from this division.

"Citro-compounds of Iron," A. B. Stevens.

"Pharmacopœial Standardization," A. B. Stevens.

"Does Oil of Sassafras contain Camphor?" Emerson R. Miller and G. H. Marsh.

"Assay of Gelsemium Root," L. E. Sayre.

B. E. Curry

Durham, N. H.

THE CHICAGO ACADEMY OF SCIENCES

The annual meeting of the Chicago Academy of Sciences was held January 10, 1911, at which time Dr. T. C. Chamberlin was reelected president; Mr. A. L. Stevenson, first vice-president; Dr. U. S. Grant, second vice-president, and Dr. Wallace W. Atwood was again made secretary. The reports of the officers of the academy showed that during the past year the work and the influence of the academy have become more strongly educational. The scientific collections and exhibits in the museum are carefully maintained and will always be available for specialists to study, but the museum is rapidly taking on a distinctly educational policy and the exhibits are being appropriately altered or replaced.

The loaning of museum material to the schools has continued; lecture courses or lessons have been offered to the children who have come as delegates from their respective school rooms; several illustrated lectures have been given at the schools; instructional courses open to the teachers of nature study have been offered and university credit courses have been conducted for those wishing to systematically pursue courses of instruction.

It is evident from the work, both of the museum and of the instructional courses given in cooperation with the work of the museum, that the academy is rapidly assuming a conspicuous place among the educational institutions of Chicago. The expressions of appreciation which have come to us from the superintendent and district superintendents of the public schools have been most encouraging. The expressions of appreciation which reach us from the principals and teachers more immediately engaged in the educational work of the North Side, are enthusiastic in praise and appreciation of the influence which the academy is having.

The opportunities for the academy lie far beyond anything which we have yet realized. The North Side of Chicago is distinctly lacking in any public institution which is actively assisting in the educational work of the schools and offering instructional courses for adults. The work of the academy should be consistently restricted to the utilization of the scientific data and material in educational work, but the opportunities within that field are among the most attractive that are open to any educational workers.

It is, indeed, somewhat surprising to see how easily the academy may become an effective instrument in the educational work of the city. There seem to have been so many gaps, so many places where we may fit in, and the regret is that we have not better facilities at the building and a larger force who may put their personal efforts into the promotion of science work among the young people and teachers of the city.

The institution has outgrown its present quarters and the demands upon it and the opportunities open to it indicate that the additional building which was originally planned for the institution should now be erected. We need a new building with an auditorium which has a seating capacity of five to eight hundred for various meetings and lectures. Class rooms, laboratories and children's work rooms in which courses of instruction may be conducted, should be provided and a children's museum should be placed in this additional space.

WALLACE W. ATWOOD,
Secretary

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 688th meeting of the society was held on January 28, 1911, President Day in the chair. Three papers were read:

Integers Useful in Computing Square Roots of Numbers: Dr. R. S. WOODWARD, of Carnegie Institution of Washington.

This paper is a continuation and extension in application of the paper on "A Method of Precision for Computing Square Roots of Numbers," presented by the speaker at the 680th meeting of the society. This paper will later appear in full in the publications of the American Mathematical Society.

A Method for Grading the Results of Tests in Judging: Dr. LYMAN J. BRIGGS, of the Department of Agriculture.

This paper describes a rational method of grading student tests in judging such as are now extensively held in agricultural schools. These tests consist in determining how nearly five or more objects can be arranged in the correct order of excellence. Since adjacent objects, when the series is correctly arranged, differ in excellence in varying degree, it becomes necessary to take cognizance of this in grading the arrangements made by different students. Furthermore, since there are seven hundred and twenty possible arrangements of six objects, the grading of the different arrangements becomes hopelessly complicated unless some rational system is adopted.

The system proposed is based upon the three following principles:

1. Any arrangement of objects departing from the correct order is brought about through the exchange of adjacent objects.

2. The error due to transposing two adjacent objects from their correct order is directly proportional to the difference in excellence of the two objects transposed.

3. An erroneous arrangement is penalized in the exact proportion that the error bears to the greatest error that can be made in the series under consideration.

In employing this system of grading the instructor first decides upon the relative difference in excellence between adjacent objects in the

series when arranged in correct order. This virtually amounts to distributing the objects properly along some numerical scale taken as a scale of excellence. Each student's arrangement of the objects is then penalized in proportion to the difference in excellence of the objects exchanged and to the number of exchanges necessary to bring about the correct arrangement. The penalty can be placed upon a percentage basis, if desired, by determining the ratio of any observed errors to that represented by completely inverting the series. The system can be applied to any series either with uniform or non-uniform intervals; it requires no tables, and it can be used with any number of objects.

The Measurement of Two Primary Base Lines with Invar Tapes: Mr. William Bowie, of the Coast and Geodetic Survey.

There are several types of base apparatus which have been used successfully in recent years by the Coast and Geodetic Survey. They are: (1) the secondary apparatus, a monometallic multiple bar system; (2) the duplex apparatus, a bimetallic multiple bar system; (3) steel tapes of 50 and 100 meters in length, and (4) nickel-steel or invar tapes of 50-meter lengths.

The secondary bars and the duplex bars gave very accurate results, yet their operation was more expensive than tapes. Tests made at the Holton base in 1891, by Professor R. S. Woodward, indicated that primary base lines could be successfully measured with steel tapes, and they were used in connection with the duplex bars in 1900 in the measurement of nine bases along the 98th meridian. In 1906 six primary bases were measured with both steel and invar tapes. It was found that the measurement of a base with tapes occupied about twenty days, while the measurement of a base with the bars had usually taken several months.

As the nickel-steel or invar base tapes were satisfactory in the measurement of bases in 1906 it was decided to use them in measuring two primary bases, one at Stanton, Tex., and the other at Deming, N. M., on the Texas-California arc of primary triangulation in 1909–10. These bases were measured by the triangulation party working in the vicinity. Owing to the small coefficient of expansion of the invar metal, it is possible to do the measuring in the hours of daylight. The coefficient of expansion of the tapes used on the primary bases by the Coast and Geodetic Survey is only about one twenty-fifth that of steel.

Four invar tapes, each 50 meters in length, were carried to the field and three of them were used in the measurement. One was held in reserve for use in case of accident to one of the other three. The tapes were standardized at the Bureau of Standards before and after the measurement of each base. The Stanton base has a length of 13,193 meters. The size of the party on this base was two observers and seven other men. One of the observers was Mr. J. S. Hill, the chief of party. During the actual measurements only six persons were engaged.

A very simple tape stretcher was used on the measurements of the Stanton and Deming bases, its weight being only eighteen pounds. The adoption of this simple and light stretcher is a step in the right direction, for the amount of measuring accomplished by a party in any one day depends largely upon the endurance of the man carrying the forward stretcher.

A base 15,554 meters in length was measured in the vicinity of Deming, N. M., in 1910, by the same party that measured the Stanton base in the previous year. The measurement of the Stanton base occupied the party seventeen days, while thirteen days were required for the measurement of the Deming base. The probable error of the measurement of the Stanton base was one part in 2,560,000, and the probable error for the Deming base was one part in 1,960,000.

Some of the conclusions which were drawn from the measurement of these two bases are: (1) the 50-meter tape was found to be both convenient and satisfactory, confirming the conclusions based upon previous tape work by the Coast and Geodetic Survey; (2) invar tapes with measurements made in daylight or at night give results which are as accurate as those obtained by the duplex base bars; (3) it is not necessary to standardize the invar tapes in the field; (4) owing to their small coefficients of expansion invar tapes give more accurate results than steel tapes; (5) with proper care during measurements in the field, the invar tape does not change appreciably in length. While not so elastic as steel, yet it is sufficiently strong to withstand the ordinary shocks due to excessive tension.

It is possible that the invar tape will not find favor with the surveyor and engineer, for general use, on account of its low elasticity, but it has proved to be a most satisfactory apparatus for the measurement of primary base lines by the Coast and Geodetic Survey.

R. L. Faris,
Secretary

THE GEOLOGICAL SOCIETY OF WASHINGTON

THE 237th meeting of the society was held at the Cosmos Club on Wednesday evening, January 11, 1911.

Regular Program

Desert Pavements and Analogous Phenomena: E. E. FREE.

Where wind scour acts on unconsolidated desert materials pebble pavements are of common occurrence. Such occurrences have been described by Blake,[1] Tolman[2] and others. As a result of similar wind scour the surface sand of stable dune areas is often coarser than that underneath. Analogous pavements are occasionally produced by water action.

Nonnezoshe—the great Natural Bridge of Southern Utah: JOSEPH E. POGUE.

Southeastern Utah boasts four natural bridges, the Owochomo, the Kachina, the Sipapu and Barohoini (Piute for rainbow) or Nonnezoshie (Navaho for stone arch), each of which surpasses in size the well-known Virginia natural bridge. The first three of these have been called by commonplace personal names, but the above names are original Indian ones and are far preferable. The largest and most southerly of the four, the Rainbow Bridge, was visited on July 26, 1910, by a U. S. Geological Survey party consisting of H. E. Gregory, in charge, John Wetherell, K. C. Heald and the writer. This imposing structure is situated in San Juan County, in a wild and well-nigh inaccessible part of the Navaho Reservation, just four miles north of Navaho Mountain and near the junction of the San Juan and Colorado rivers.

The La Plata (Jurassic?) sandstone, here 1,200 feet or more in thickness, is deeply dissected by a labyrinth of tortuous canyons, and near the mouth of one of these the bridge is found. A towering arch, rainbow-shaped and of model symmetry, rises from a ledge on one side of the canyon, and spanning a small stream, joins the opposite wall on its downward bend. The opening measures 267 feet in height by 278 feet between abutments; but the distance from stream bottom to top of arch totals 309 feet, while the keystone portion is only 42 feet thick by 33 feet wide. The arch is carved from a buff-colored massive phase of the La Plata sandstone, and represents an opening, enlarged and shaped by desert weathering, through which the stream originally cut off one of its meanders. The abandoned meander remains as a proof of this origin.

The bridge was discovered on August 14, 1909, by W. B. Douglas, of the U. S. General Land Office, with four assistants, and Byron Cummings, of the University of Utah, with three students, under the guidance of John Wetherell and two Navaho Indians. It has subsequently been set aside as a national monument and represents the largest and most graceful structure of its kind thus far known.

Criteria for an Unconformity in the so-called Laramie of the Raton Mesa Coal Fields of New Mexico and Colorado: W. T. LEE.

During the summer of 1910 the unconformity in the coal-bearing rocks of the Raton coal field of New Mexico, first announced in 1908 and published upon the following year, was traced around the Raton coal field in New Mexico and the Trinidad coal field in Colorado, an area extending about ninety miles along the east front of the Rocky Mountains and stretching eastward to a maximum width of fifty miles. The evidences of unconformity may be grouped under two general headings, stratigraphic and paleontologic.

The formation below the unconformity is coal-bearing and varies in thickness from about 450 feet to 0. The formation above the unconformity is likewise coal-bearing and is marked by a constant basal zone of conglomeratic sandstone. The relation of the basal conglomerate of the upper formation to the beds below leaves little room for doubt that the variation in thickness of the lower formation is due to erosion. In at least four places the lower coal-bearing formation is wanting and the basal conglomerate of the upper one rests upon older rocks. This basal conglomerate contains pebbles of coal which must have come from the lower coal formation, pebbles of conglomerate which could come only from the Dakota, stratigraphically about 3,500 feet below, or from some formation still older; pebbles of red sandstone which could come only from the red beds, the top of which is about 4,000 feet below; pebbles of horn corals and fossiliferous cherts, such as are now found in the Carboniferous rocks west of the coal fields, about 18,000 feet below; and a variety of metamorphic and igneous rocks, including crystals of feldspar supposed to come from the crystalline complex of the mountains. Apparently these pebbles prove that after the earlier coal measures were formed the mountains west of the Raton Mesa region were elevated and the upturned stratified rocks, having a measured

[1] Rept. Pac. Ry. Surv., 5: 230, 1856.
[2] *Jour. Geol.*, 17: 149–151, 1909.

thickness of more than 18,000 feet, were eroded before the basal conglomerate of the upper coal measures was laid down.

The paleontologic evidence is almost wholly from the fossil plants, which apparently indicate a time break of considerable duration. Large collections were made from both formations and F. H. Knowlton, who is studying them, states that tney contain two distinct floras. However, correlations are withheld pending the final study of these fossils.

The data collected apparently prove that after the lower part of the coal-bearing rocks in the Raton Mesa region, heretofore referred to the Laramie, had been consolidated the mountains to the west were uplifted and part of these rocks, together with all of such younger beds as may have been deposited, were eroded away before deposition of sediments was resumed in this region. The general conclusion is reached that the so-called Laramie of the Raton Mesa is divisible into two distinct formations separated in time by a period of considerable duration.

Robert Anderson,
Secretary

THE TORREY BOTANICAL CLUB

The meeting of December 13, 1910, was called to order at the American Museum of Natural History at 8:30 P.M., Tuesday, December 13, 1910, with President Rusby in the chair. One hundred people were present.

The scientific program consisted of an illustrated lecture by Dr. Marshall A. Howe on "A Visit to the Panama Canal Zone."

The visit described by the speaker occurred in December, 1909, and January, 1910, and was undertaken under the auspices of the New York Botanical Garden, with the special object of studying and comparing the marine floras of the Atlantic and Pacific oceans, here within less than fifty miles of each other.

The marine algæ proving unexpectedly scarce, especially on the Pacific side of the isthmus, there was considerable opportunity for taking photographs of general botanical interest and the lantern-slides shown illustrated chiefly some of the more striking features of the land flora of the Canal Zone, such as the numerous native palms, the vegetation of the extensive fresh-water swamps between Colon and Gatun, the swampy forests bordering the Chagres River, and the flora of the rocky islands of Panama Bay. A report covering some of these features of the lecture was published in the *Journal of the New York Botanical Garden* for February, 1910.

The speaker justified a somewhat extended discussion of the Panama Canal and its history by the general interest in the subject both here and on the isthmus. Among the photographs shown were several of the Atlantic and Pacific entrances to the canal, the Gatun locks, a flood on the Chagres River, the Culebra Cut, the Ancon Hospital and the Taboga Sanitarium. The success of modern sanitary methods in combating yellow fever and malaria was especially dwelt upon. The speaker alluded also to incidents of interest in the romantic early history of the isthmus and in the building of the Panama Railroad. Photographs of the ruins of Old Panama, located about five miles east of the present city, were also shown.

Sereno Stetson,
Secretary pro tem.

THE AMERICAN CHEMICAL SOCIETY
NEW YORK SECTION

The fifth regular meeting of the session of 1910–11 was held at the Chemists' Club on February 10.

The chairman spoke of the great loss to the society in the death of Professor Kinnicutt and called upon Dr. Clifford Richardson to make a few remarks about his career. Professor Morris Loeb paid a further tribute to Professor Kinnicutt and then, passing from a matter of deep regret to one of rejoicing, spoke of the festivities connected with the opening of the new chemists' building in New York, beginning March 17.

The chairman read a letter of regret from Professor Boltwood, who was unable to be present to read a paper on "Radio-chemistry," announced on the program. He then called upon Professor A. T. Lincoln, of Rensselaer Polytechnic Institute, who presented a résumé of recent work on the subject of solutions under the title "The Hydrate Theory."

The rest of the evening was devoted to a symposium on milk, which comprised the following subjects:

"Determination of Total Solids in Milk," Paul Poetschke, of the Lederle Laboratories.

"Milk Costs," W. E. J. Kirk, medical adviser to the Borden's Condensed Milk Company.

"Raw and Pasteurized Milk and Milk Serums," Edward Gudeman, of Chicago.

C. M. Joyce,
Secretary